MARCH, 1956

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PIPE LINE INDUSTRY

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CONSTRUCTION • OPERATIONS • MAINTENANCE

ONE COPY SENT TO MAR 29 1956

What's Being Done About Corrosion

New developments in corrosion engineering indicate continued progress. For a look at what's being done, turn to Page 19

Watch This New Compressor Station

Gulf Interstate's Stanton, Ky., remotely-controlled compressor station is on line. Tests of new features will be watched. Page 38

How to Select Filtering Equipment

Perhaps a neglected phase of pipelining . . . proper selection and application reduces engine maintenance. Page 44

Turn page for additional contents and a Quick Review of this issue

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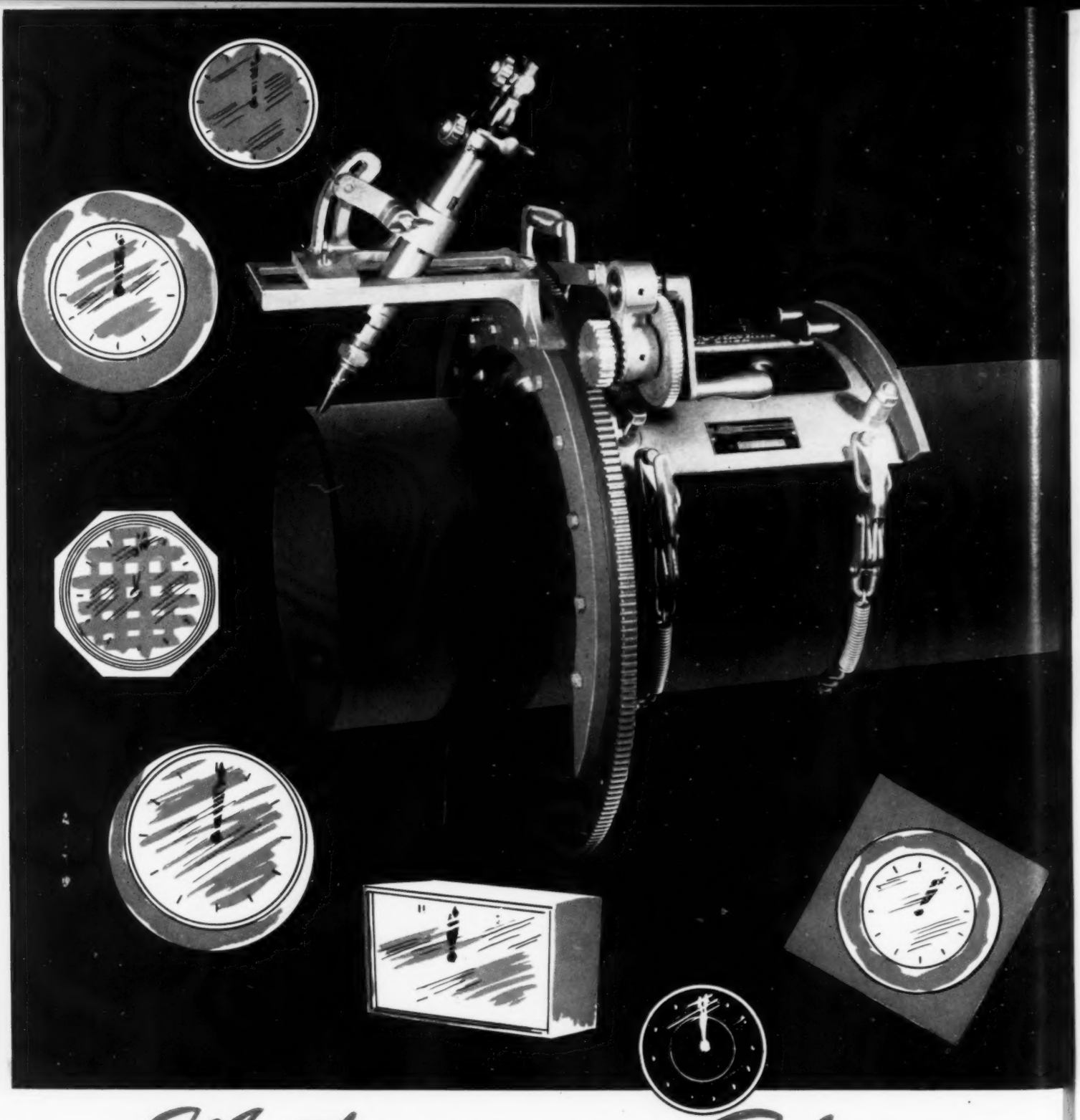

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The hands of the clock can always help sell a product. Everyone is looking for time — the priceless commodity. Show a customer how to save time and he'll convert that saving to money. H & M Pipe Cutting and Beveling Machines have saved pipeliners and pipe fabricators millions of minutes, amounting to thousands of hours, earning those men hundreds of dollars. Meet the top salesmen for H & M . . . the clocks of the industry.

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PIPE LINE INDUSTRY

March, 1956 Vol. 4, No. 3

CONTENTS and Quick Review

To help you put first things first, scan these time-saving digests, checking ☑ those you want to read first.

PROGRESS REPORT ON CORROSION CONTROL

☐ Beginning on Page 20 are 18 pages designed to give the pipe line man who is not a corrosion engineer information he can use to cut costs. On these pages you will find information on internal coating . . . some pitfalls to avoid in cathodic protection design . . . and the story of how cooperation pays off in corrosion control.

There is also an explanation of how anode installation equipment mounted on the gin pole truck speeds up cathodic protection work . . . plus some hints on how to make a good coating job better . . . and the story of a new dual-purpose coating.

You'll find these stories on the 18 pages:

What to Expect from Internal Coating — J. C. Watts	20
Pitfalls to Avoid in the Design of a Cathodic Protection System — Wayne A. Johnson	24
Cooperation Helps Control Corrosion — C. L. Mercer	27
Pipeliners Put Farm Tools to Work — M. J. Olive	29
12 Musts for a Good Coating Job — Marshall E. Parker	31
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For more about these articles on corrosion, turn to Page 19.

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Watch Gulf Interstate's New Compressor Station

☐ This new engine-driven centrifugal compressor station at Stanton, Ky., will be remotely controlled from a station 80 miles upstream. Operating tests of many new features will be watched closely by gas transmission industry. . . . . Page 38

Lone Star Trains Leaders by Passing Authority Down

☐ How can company leaders find the time for vital future planning in a growing company? Here is a plan of organization that combines many advantages of the functional and regional structures to distribute detailed work and authority. Read how Lone Star Gas Company did it.

M. L. Bird . . . . . Page 42

How to Select Filtering Equipment

☐ It has been pointed out that the selection and application of filters for a pipe line pump station is too often given too little thought. Yet the proper selection of filters and proper application can cut engine maintenance costs. This article tells how it can be done.

Charles A. Winslow . . . . . Page 44

Trucks Transport Gas During Line Shutdown

☐ It's not the first time this trick has been tried, but one of the most successful. Trucks supplied emergency gas to a small Kansas town during a shutdown. For details on how it worked, turn to Page 40.

How to Calculate Pipe Stresses

☐ You'll find this method a big time-saver in computing stresses in three-dimensional piping systems, as well as making the whole procedure much simpler. Compared to tedious conventional methods, this one will help you avoid common errors. The second part of this three-part series shows you how to use the tabular method when the system contains branches with different moments of inertia.

By K. Hao Hsiao . . . . . Page 51

Surplus Storage Tanks Put to New Use

☐ One rule in the pipe line business is to make good use of all available material and equipment. And in Oklahoma they have come up with a new wrinkle . . . the storage of grain in old 55,000-barrel tanks that are no longer needed for crude storage . . . . . Page 55

PIPE LINE INDUSTRY published every month. Entered as second class mail matter July 9, 1954, at the post office at Houston, Texas, under the act of March 3, 1879.

What Will Labor Union Merger Mean?

We were sorry to see the merger of the CIO and the AFL—sorry because we foresee ahead some serious trouble for our country as a result of this merger.

In the past, although occasionally some of its individual unions have been chock-full of racketeering and corruption on the part of union leaders, the AFL, generally speaking, has held a good reputation and has been a strong proponent of individual enterprise.

On the other hand, the CIO is nothing more or less than a front for Socialism as its platform has shown on more than one occasion. It has been our observation that every time the CIO has organized the plant of some acquaintance or friend, that organization was immediately followed by trouble. We know of instances where companies have deliberately refrained from the purchase of certain types of machinery because it was customary to have that type of machinery operated by a CIO operator—and a CIO operator meant trouble.

•

One of our strongest reasons for our opposition to the merger and our fear of its consequences lies in the single word "monopoly." We believe that our laws against monopoly in business are sound and are necessary. But we believe too that they should be extended to include unions as well.

A union officer has no more right to engage in a conspiracy against trade than does an industrial concern executive.

In the past the AFL has afforded some slight brake on the CIO in that the CIO appreciated at least the AFL segment of public opinion. If the two are joined together we fear that this braking action may be lost.

We are afraid that we may see all over the U. S. the occurrence of the shameful episode that has been occurring in the Kohler plant in Wisconsin. A more dastardly effort to destroy private enterprise has never been invented than that used in the Kohler plant by the CIO.

•

We have been an employer of union labor (International Typographical Union, affiliated with AFL) and have gotten along well with our union employes.

If a quick split doesn't arise between the AFL and the CIO elements of the new union, AFL men may well expect to see the militant, pushing CIO leaders take over. And that is a prediction. Whether they will be powerful enough to turn the country into Socialism is another thing—but the threat is there.

Ray L. Dudley

They're pumping gas to underground storage with this "Oilwell" Direct-Connected Compressor Unit

STUDY this photograph a minute! It's an "Oilwell" DGE-125 direct-connected duplex compressor unit that has just been delivered to location—ready for foundation bolts and piping connections.

It's truly a "packaged unit," even to pressure gages, controls and up-draft cooling facilities for engine and compressors, all mounted on a structural steel skid base.

Note the narrow width of these parallel compressors, powered by an in-line direct drive from the engine through right-angle, spiral-bevel gears.

In this installation . . .

. . . natural gas is being taken from low-pressure field lines, compressed and injected into underground formations which previously contained gas for storage near Zanesville, Ohio. Two 9-inch stroke compressors—one cylinder with 5½-inch diameter and the other with 3⅛-inch diameter—constitute this two-stage, duplex-type unit, which is capable of handling up to 744,000 cu. ft. of gas per day with 125 psig suction and 1,200 psig discharge at compressor speeds of 325 rpm.

Let an "Oilwell" Engineer . . . assist in the selection of the compressor for your next installation, from one of these completely packaged duplex-type units. They're available in 125, 175, 200, 250 and 300 hp sizes.

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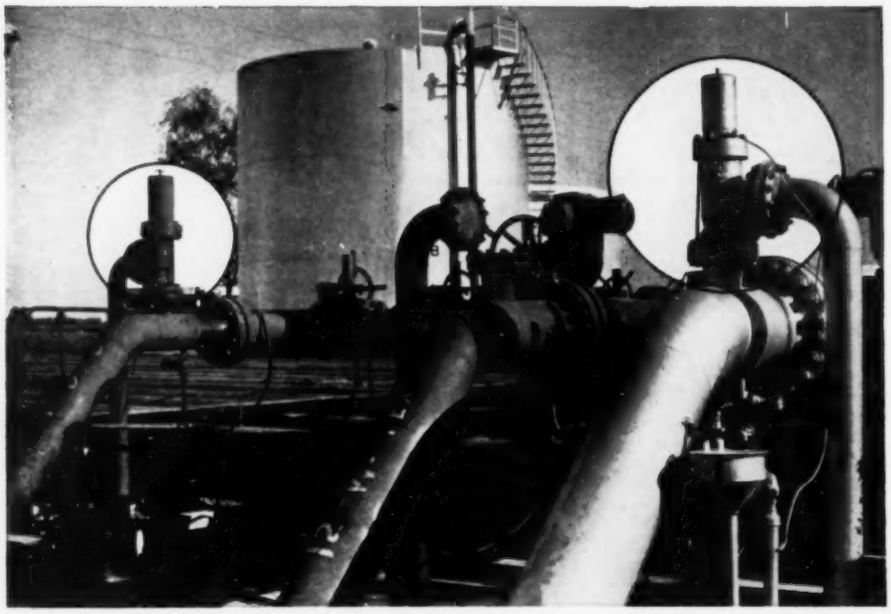
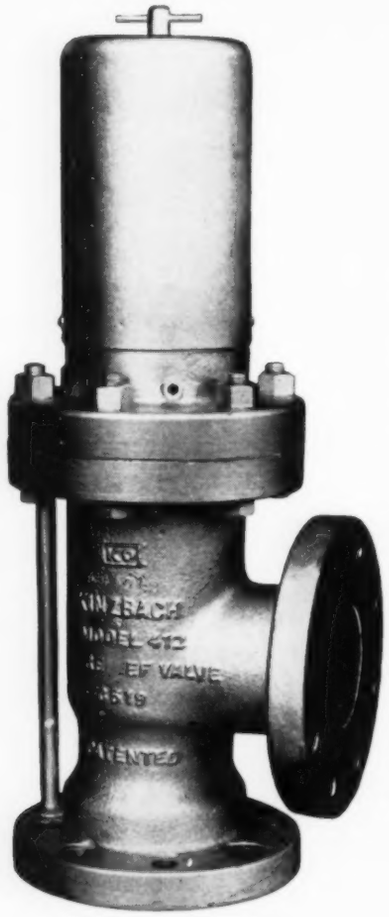


Positive Protection Against Pressure Surges



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Kinzbach Model 412 Relief Valves are available in 2", 3", 4", 6" and 8" sizes for working pressures up to 1000 p.s.i. Write for Bulletin RV412 for full technical data.

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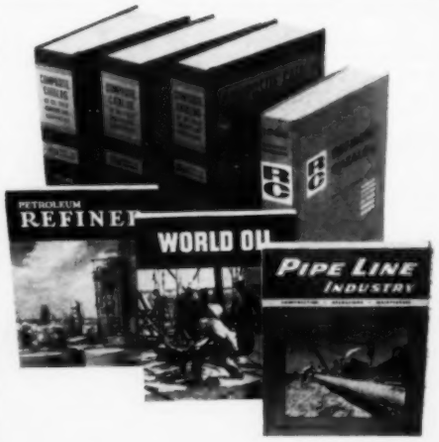
PIPE LINE INDUSTRY



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PETROLEUM REFINER and **THE REFINERY CATALOG** for the refining-natural gasoline-petrochemical industry.

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Even in Alaskan muskeg swamp
CAT* Engines keep the ditch up with the pipe

The Haines to Fairbanks pipeline gave Caterpillar Oilfield Engines a test that has rarely been equalled. Half the Alaskan section of the eight-inch line is underground and Williams Brothers put it there through muskeg and permafrost.

A rough-and-ready Cat D8800 powered a Cleveland 320 Ditcher in the huge muskeg swamp shown here. A foot to 30 inches down through the moss-like muskeg lay permafrost. The entire area was covered with water. As the ditcher dumped the permafrost to one side, it thawed and produced virtually impassable mud. River clamps had to be placed on the pipe at every joint. Yet with a Cat D6 Tractor towing the ditcher and a Bucyrus-Erie backhoe—powered by a dependable D315—clearing the way, Williams Brothers was able to ditch 3500 feet each 24 hours in the swamp.

The ditcher with a small heavy-duty wheel and two extra buckets proved it was possible to dig permafrost. Five and six rooter teeth were placed alternately on each bucket. Thus equipped, the ditcher cut more than 110 miles of trench with a new set of teeth every shift.

Reported G. R. Hamilton, ditching superintendent: "It was pioneering and our Cat equipment did all right. They'll stand rough treatment. We winched them through creeks and proved they're waterproof."

And now the Caterpillar D339 Diesel with more power (140 HP maximum at 1200 RPM) has replaced the famous D8800 in the Caterpillar line of oilfield engines and electric sets. As dependable as they *were* in the roughest going—*they now are even better.*

It's a good time to see your nearby Caterpillar Dealer. He has new money-saving oilfield power to show you.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

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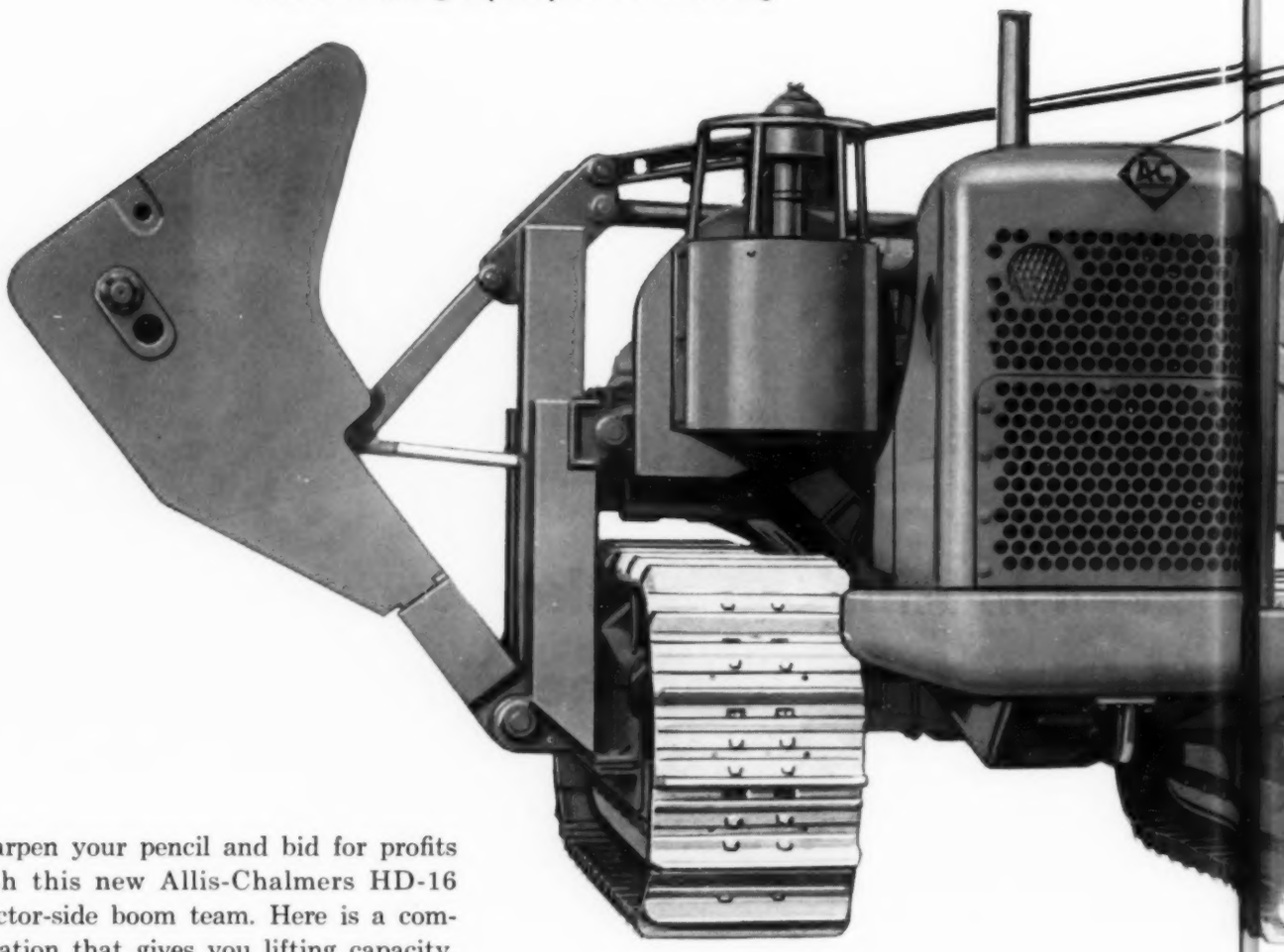
MODERN HEAVY-DUTY OILFIELD ENGINES

Another New Big Production

150 net engine hp

Weight — 57,840 lb, tractor and side boom with full counterweight

77,500-lb lifting capacity at 4-ft overhang



Sharpen your pencil and bid for profits with this new Allis-Chalmers HD-16 tractor-side boom team. Here is a combination that gives you lifting capacity, stability and safety to take on big pipeline jobs—yet keeps operating costs down.

• New Allis-Chalmers Engine

This Allis-Chalmers heavy-duty diesel engine offers quick starting with smooth, long-life performance. High power output with big reserve capacity means low maintenance costs.

• Proved Torque Converter Power

The HD-16 gives you the outstanding advantages of proved torque converter drive — smooth, cushioned power for tractor and boom, most shifting eliminated so operator can concentrate on pipe work. With full horsepower available at all times, the HD-16 matches speed perfectly to slow-moving clean-prime, dope-wrap machines, even on steep grades.

• Unmatched Stability in Its Size Class

Eighty-four in., center-to-center tread width, up to 24-in. track shoes and long track with seven heavy-duty truck wheels give this crawler tractor balance and stability to boom out the big loads. Double reduction final drives and smooth, clean bottom construction provide extra clearance to skim over obstacles. And with torque converter permitting tractor to ease smoothly into motion, there's no tendency for tracks to dig in.

• Easy to Operate and Service

With direct electric starting on diesel fuel, hydraulic, finger-tip steering, self-energizing brakes and comfortable foam-rubber seats, operator gets more work done. You save on maintenance time with such outstanding features as simplified adjustments, fewer lubrication points and 1,000-hour lubrication periods for truck wheels, idlers and support rollers.

For more data on advertised products, use Readers' Service Cards, last page.

Pipe Team *from Allis-Chalmers*

HD-16 tractor with hydraulic torque converter drive

Tractomotive heavy-duty side boom

Safe, Husky Side Boom

Side boom features drop-proof safety counterweights; internal expanding brakes, fully enclosed from dirt and moisture; easy-working, convenient controls; and constant mesh transmission. It's built to take full advantage of the HD-16's big lifting capacity.

• Big Output – All the Way

The HD-16 is newly engineered throughout to give you big safety factors and long life in every component. This tractor, whether equipped with dozer or side boom, will give you big production under tough, as well as average, conditions — help you hold down costs on every job you bid.

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IN TANDEM AND 3 AXLE UNITS

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CALL YOUR NEAREST **LUFKIN MAN** LET HIM EXPLAIN HOW A LUFKIN 3 AXLE TRAILER WILL HELP YOU WITH YOUR EXTRA HEAVY LOADS.

◀ ANOTHER LOAD ARRIVES SAFELY VIA **LUFKIN'S NEW TOF-H**

Comes Lufkin Standard with 12" "I" beam center frame and 8" outside frame–outside "I" beams are boxed with ¼" plate for added strength and fish plated inside to assure performance if trailer is dropped – all cross members are "I" beam construction.

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Kontol 77 Corrosion Inhibitor protects pipe lines against corrosion and scaling. In addition, its detergent characteristics prevent fouling and help to maintain a high "C" factor.

Kontol 77 is applicable for the protection of all petroleum pipe lines, from crude oil service to finished products lines. It meets military specifications as an approved rust and corrosion inhibitor for use in jet fuels and automotive gasoline.

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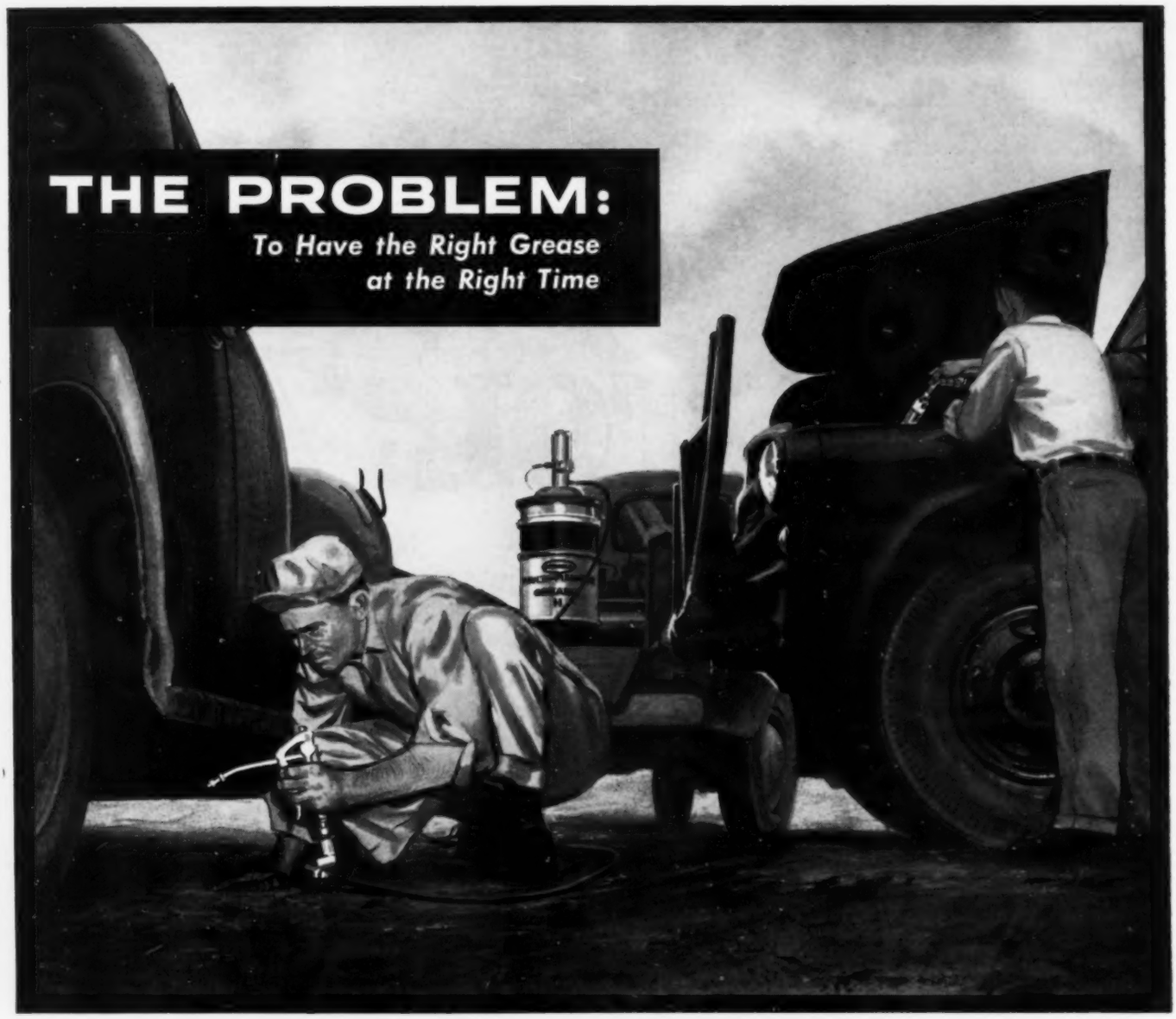

THE SOLUTION: *Humble's* MULTI-PURPOSE GREASE H

Humble's Multi-Purpose Grease H is designed for superior performance in the widest practical range of applications. Its quality equals or exceeds that of every specific single-purpose grease it replaces. Multi-Purpose Grease H reduces the chance of grease misapplication, and simplifies your transportation and field storage problems.

Multi-Purpose Grease H gives excellent service as a chassis, track roller, wheel bearing, water pump, ball and roller bearing, and universal joint lubricant, as well as other uses.

For complete information on Multi-Purpose Grease H, see your nearest Humble wholesale plant in Texas and New Mexico, or write or phone:

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Humble Oil & Refining Company,
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HUMBLE

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"John Crane" Type 8-B Seals were installed in two high pressure 3-stage centrifugal pumps at the Akron, Alabama, Station, operated by Plantation Pipe Line Co. Pumps operated for 2½ years without shutdown. At the end of that time they were opened for inspection and parts repair. The seals, including rubber parts, were in perfect working condition. New 8-B Seals were ordered to insure repetition of this remarkable performance record. Old ones were rebuilt to serve as spares.

Here is further proof that wherever service is tough "John Crane" 8-B Seals are successfully doing the job. This is the reason why 75% of the seals installed in crude and product pipe lines within the last several years have been "John Crane" Seals.

You can get this same performance. Contact Crane Packing Co., 6434 Oakton St., Morton Grove, Ill., (Chicago Suburb). *In Canada: Crane Packing Co., Ltd., 617 Parkdale Ave., N., Hamilton, Ont.*

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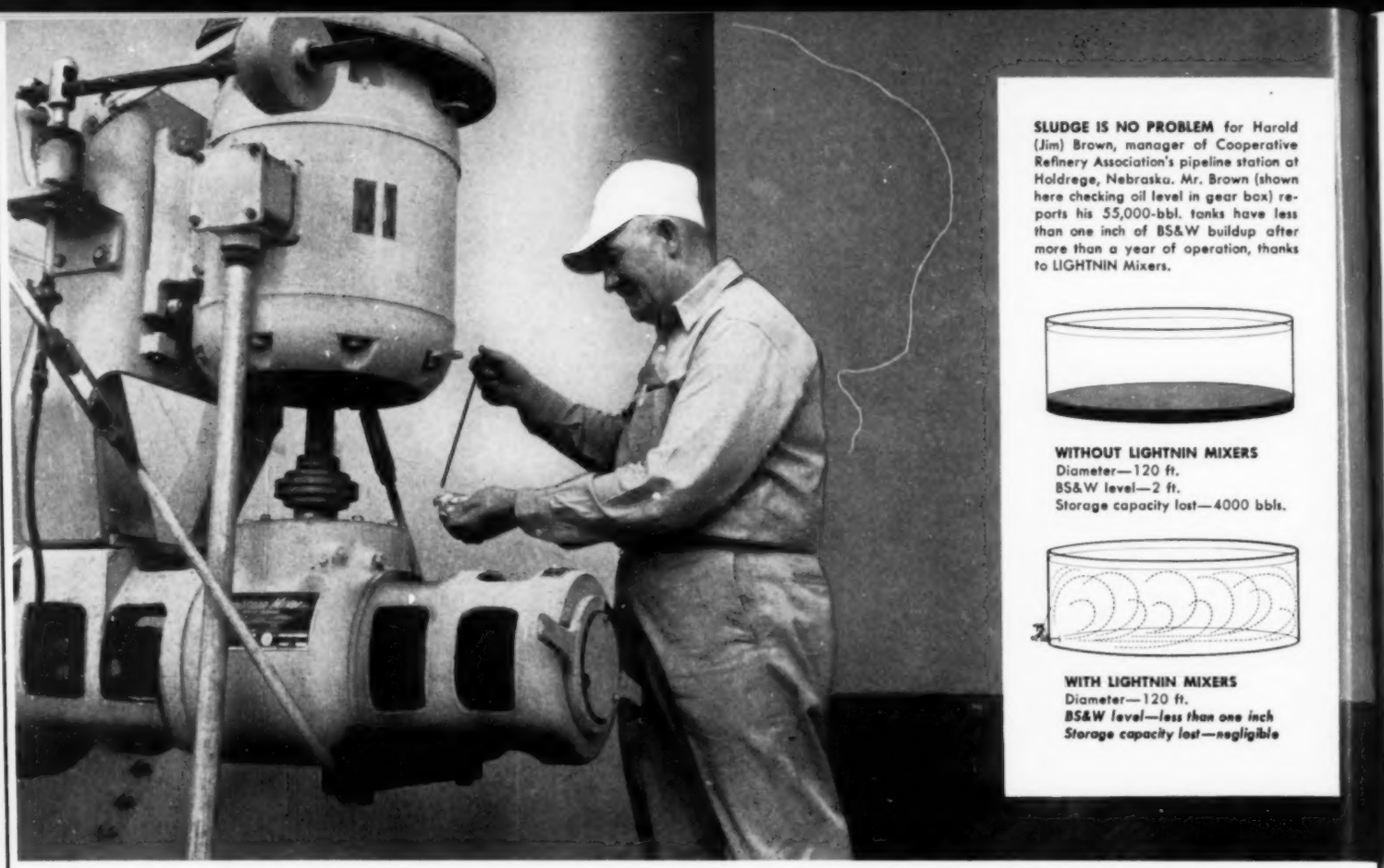

SLUDGE IS NO PROBLEM for Harold (Jim) Brown, manager of Cooperative Refinery Association's pipeline station at Holdrege, Nebraska. Mr. Brown (shown here checking oil level in gear box) reports his 55,000-bbl. tanks have less than one inch of BS&W buildup after more than a year of operation, thanks to LIGHTNIN Mixers.

WITHOUT LIGHTNIN MIXERS
Diameter—120 ft.
BS&W level—2 ft.
Storage capacity lost—4000 bbls.

WITH LIGHTNIN MIXERS
Diameter—120 ft.
BS&W level—less than one inch
Storage capacity lost—negligible

Is sludge hogging your tank capacity?

Cooperative Refinery Association cleans tanks by flipping a switch. So can you.

Sludge is a tank hog. It eats up valuable tank capacity you badly need for crude. It's a messy tenant, too, and cleaning up after it is a costly, dirty job.

Rid your tanks of sludge, and you add as much as 12% more capacity to your pipeline stations.

Cooperative Refinery Association brings crude oil from Wyoming to its pipeline station at Holdrege, Nebraska, stores it in two 55,000-bbl. tanks. When the crude moves on to the refinery at Phillipsburg, it leaves a minimum of BS&W in the tanks. In more than a year of operation, scarcely an inch of sludge has accumulated in either tank.

Simple method pays off

Secret? Cooperative Refinery Association equipped each tank with a LIGHTNIN Side Entering Mixer. When temperature falls below 70°, these mixers go to work for about four hours a day. They keep bottoms stirred, prevent oil from congealing. When the oil moves on, each tank is ready to take on a new supply—without cleaning—and at full capacity.

LIGHTNIN Mixers are keeping storage tanks free of sludge at many pipeline stations, increasing storage capacity, eliminating downtime for cleaning, making every barrel in every tank merchantable crude oil.

Here's why you can't lose

You take no risk when you order a LIGHTNIN. Every one is unconditionally guaranteed to perform its job—or your money back.

Learn how LIGHTNINS can solve your sludge problems, make your tanks work harder, cut your costs. Call in your LIGHTNIN representative, or write us today.

Lightnin® Mixers

MIXCO fluid mixing specialists

Get these helpful facts on BS&W control and LIGHTNIN Mixers. Check, tear out and mail to us today with name and company address. Free—no obligation.

- ☐ B-503 Illustrated bulletin on BS&W control
- ☐ B-104 20-page catalog fully describing LIGHTNIN Side Entering Mixers
- ☐ B-107 Mixing Data Sheet
- ☐ B-110 Condensed Catalog describing LIGHTNIN Mixers of all types
- ☐ B-111 Bulletin describing LIGHTNIN rotary mechanical seals for extra-low-cost mixing

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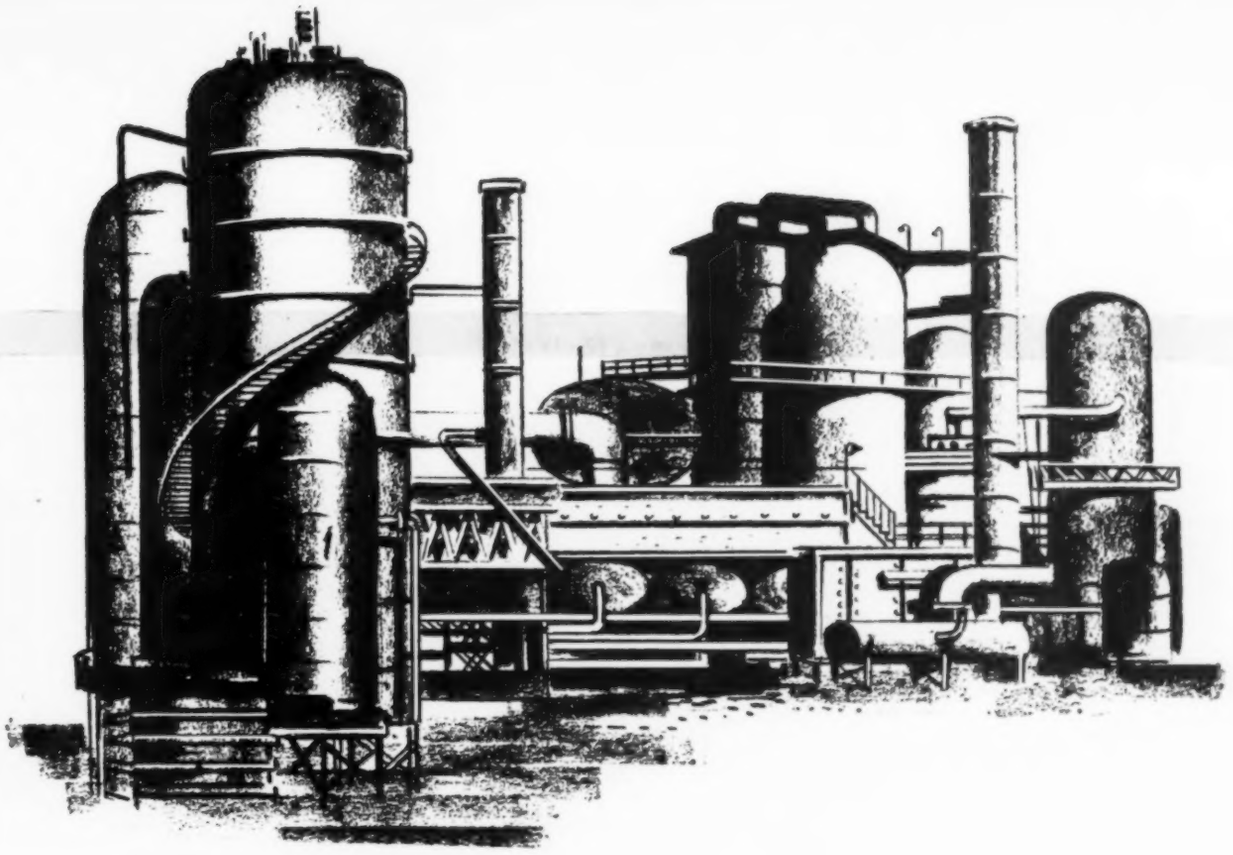
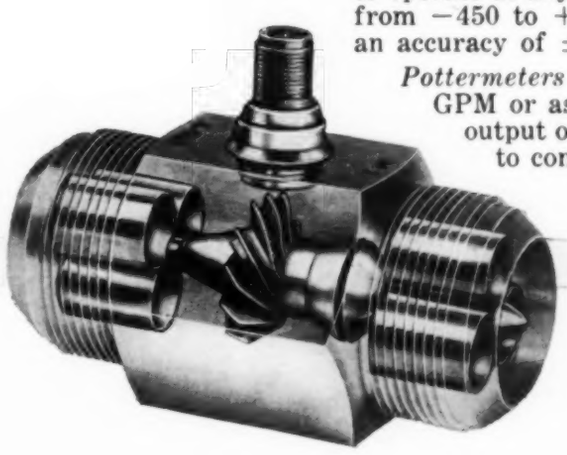


FOR VITAL FLOW CONTROL

WHETHER you're developing a new process or modernizing an old one—investigate the unique characteristics of the bearingless *Pottermeter.*

This electronic flowmeter—easily installed in any type of piping to operate at any angle, at any pressure and at temperatures from −450 to +1200°F, measures flow of any liquid with an accuracy of ±½ of 1%.



Pottermeters are available to measure flows as low as 0.07 GPM or as high as 3,000 GPM. The inherently linear output of the *Pottermeter* makes it ideal for systems to control either flow rate or total flow.

Find out how the bearingless "floating rotor" used in the *Pottermeter* can give you more precise flow measurement, longer trouble-free service life, and more accurate flow control.

Write for Bulletin PS-1

Potter **POTTER AERONAUTICAL COMPANY**

Route 22 • Union, New Jersey • Phone MUrdock 6-3010

Makers of "Potter Engineered" products

For more data on advertised products, use Readers' Service Cards, last page.

HERE'S 23 YEARS OF PROOF THAT COAL TAR COATINGS LAST LONGER!

THIS coal tar-protected pipeline was buried 23 years in soil permeated with salt water and industrial refuse. But when it was unearthed for inspection, the coating showed no signs of deterioration or failure of any kind!

Isn't that the kind of *proven* protection *you* want? It's the kind of protection you *get* when you specify *Pitt Chem* Coal Tar Pipeline Coatings. For these coatings have demonstrated their tremendous ability to resist soil stress and water absorption—the two principal reasons why "economy" coatings eventually fail.

When you buy *Pitt Chem,* you buy assured pipeline protection with every drum, because *Pitt Chem* Coal Tar Coatings are manufactured to published specifications. ● Call on a *Pitt Chem* man to help you plan your next pipeline protection job. He's fully equipped to give you valuable technical assistance . . . and to guide you to long-run protection economies.

PITT CHEM® TAR BASE COATINGS

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- Plasticized Grade • Hotline
- Cold Applied Tar Base Coatings

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PITTSBURGH COKE & CHEMICAL CO.

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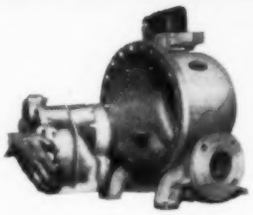

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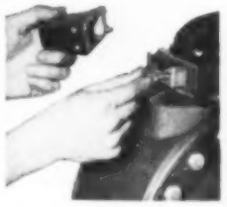

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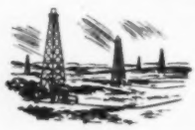

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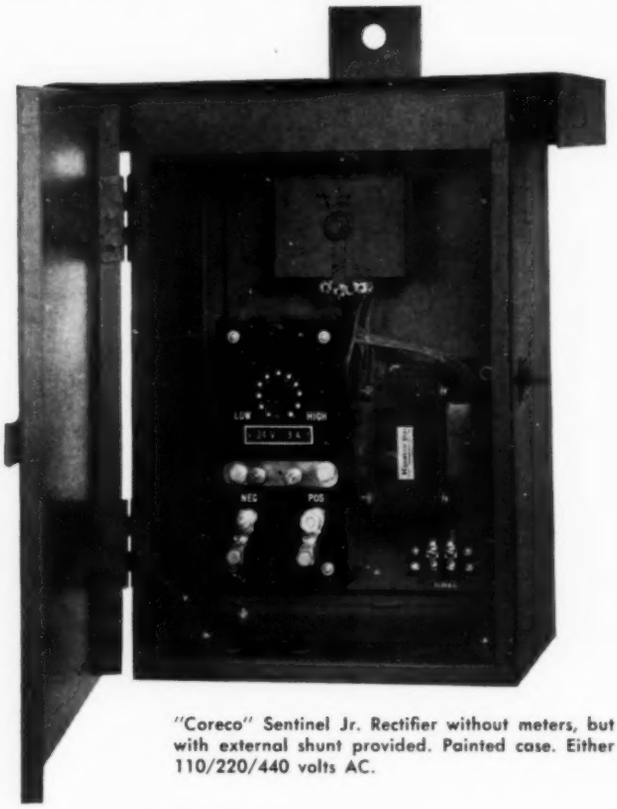

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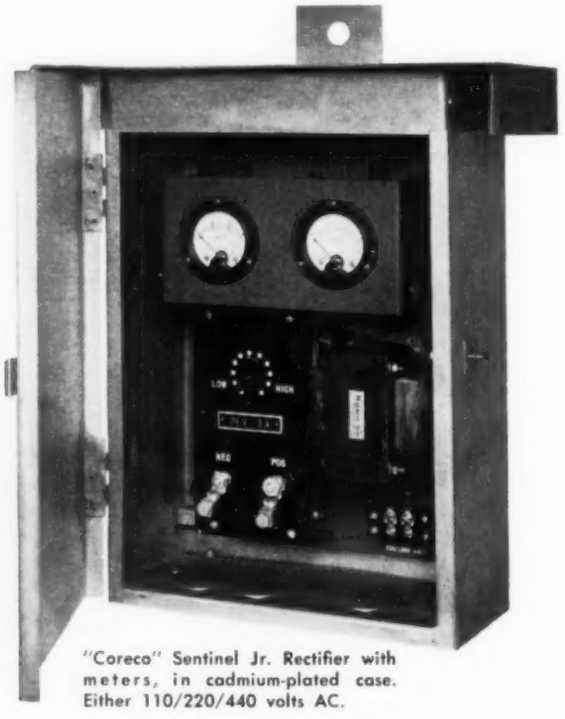

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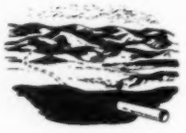

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Progress Report on Corrosion Control

20 **What to Expect from Internal Coatings**
Improved coating materials, efficient application methods, and some eight years of field performance have advanced practices to an engineering science. And new developments promise to make them even more useful.

24 **Pitfalls to Avoid in Design Of Cathodic Protection System**
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Corrosion engineers of Arkansas Fuel Oil Corporation have developed some highly mobile equipment for installing cathodic protection systems . . . at a cost that will amaze you.

31 **12 Musts for a Good Coating Job**
Careful attention to good practices during construction operations can produce a well-protected pipe after it is backfilled. Here are 12 points to keep in mind.

35 **A New Coating Method**
Recent developments in dual-purpose asphalt mastic weight coating for submarine lines have stirred widespread interest. One manufacturer compacts the material on the pipe and begins cooling while it is under pressure.

Thorough cleaning is the first step in coating a pipe line internally. A wad of steel cuttings is packed into the open pup joint. Compressed air behind a pig will force the wad through the line to remove dirt, oil, scale and deposits.

The wad of steel cuttings emerges from the downstream end of the pipe. Several passes may be necessary to clean the line thoroughly.

What to Expect From Internal Coatings

New coating materials plus improved methods of cleaning and application will give a quick payout on many lines . . . but they are no cure-all.

By J. C. WATTS
Internal Pipeline Maintenance Company, Odessa, Texas

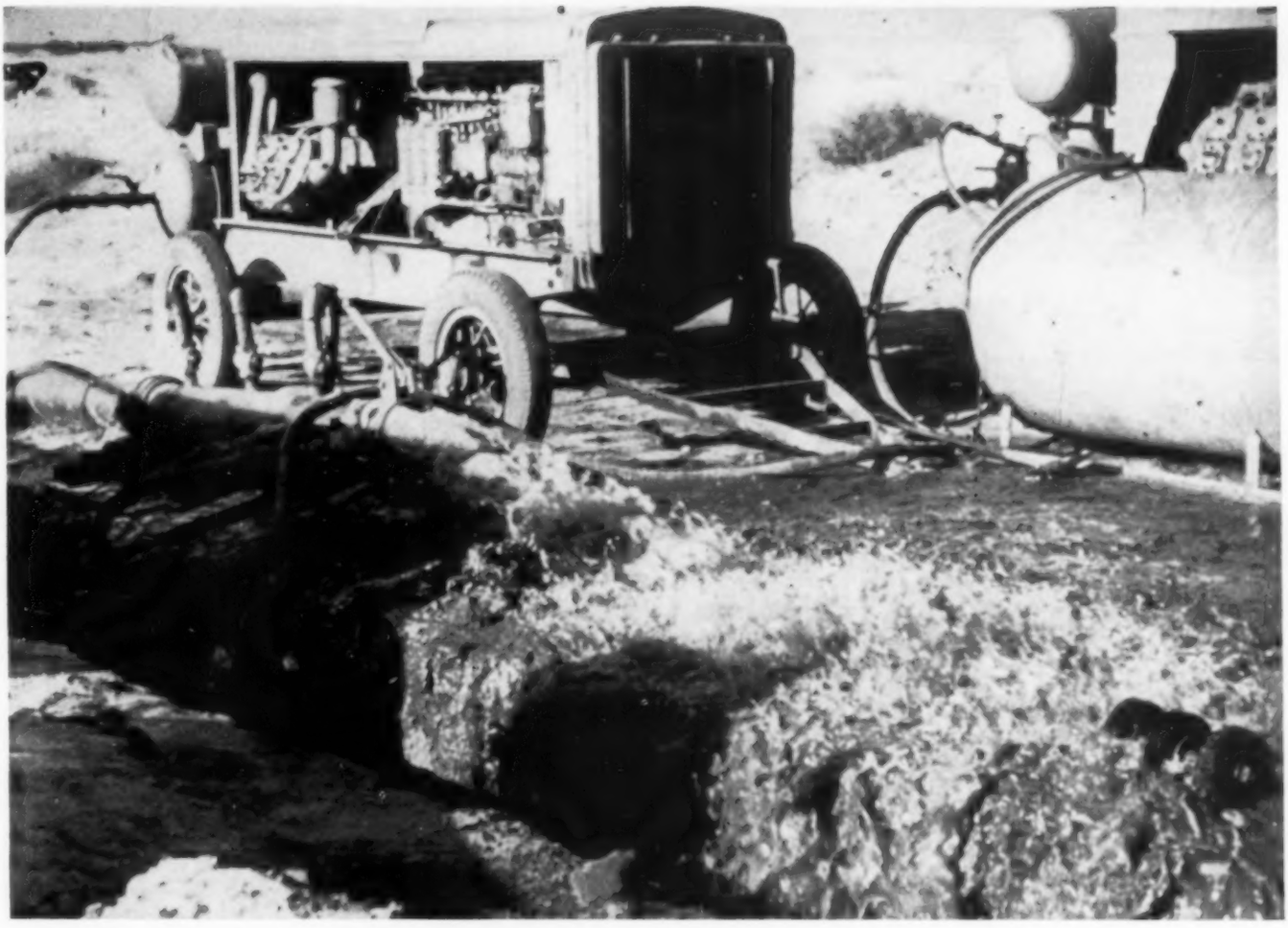
INTERNAL COATING of pipe lines in place is gaining attention as a useful tool for the corrosion engineer. Within the past eight years nearly 1000 miles of line has been protected by this method. Sizes have varied from 2-inch up to 18-inch; lengths of individual coating jobs vary from just a few hundred feet to 18 miles. With improved coating materials, more efficient application methods, plus better records of field performance, it is now possible to predict more accurately the results expected from in-place internal coating jobs.

If economics indicates that internal coatings offer the best solution to the problem, the next step is to decide what type of coating to use. There are two basic types of organic coating materials being used for in-place internal coatings. Vinyls have had the longer service, some as much as eight years in crude oil, fresh water, salt water, and natural gas lines. Up to three years service has been obtained with the epoxy coatings in similar services. Although the epoxies are a more recent development and consequently have been in service a shorter time, they show evidence of being equal to or better than the vinyls for most services.

Because of their excellent application properties, epoxy coatings are usually recommended where they are suitable for the service. Other distinct advantages of the epoxies are their resistance to aromatic hydrocarbons, and their ability to withstand temperatures up to 250° F.

Proper Application Essential. For lines already in service, in-place application is often the most practical method. But for new pipe line construction, coating may be sprayed on individual joints. Except for very short lengths of pipe, cost of the in-place application will usually be less.

In the application of in-place coatings, the material is deposited in a continuous film, under pressure. Coating is forced into the most minute crevices and completely around and into any remaining traces of scale. Thus air is expelled. The coating also will be forced into the



Water wash with a detergent solution may also be used to clean some lines. Cleaning solution and pig carry line deposits out of the line.

threads of a screw line. Conditions of the surface, as well as wetting ability and flow properties of the material, are less critical than for spray application. This may be one reason why satisfactory service has been obtained even from early jobs where the coating was applied over poorly prepared surfaces.

Drying of the internal coating is carried out at a controlled rate. This keeps the surface of the film wet and prevents solvent from being trapped in the film. Drying rate is controlled by regulating the amount of air blown through the pipe and holding it under a slight positive pressure. Careful control minimizes the danger of the drying air becoming saturated with solvent and causing washing.

How Long Must Line Be Out of Service? It is often difficult to estimate the shutdown time. The amount of cleaning necessary is the most important factor in the schedule. If the line cannot be taken out of service long enough to do the job well, it is best to lay a temporary bypass.

As an example of the time involved, a mile of new 4-inch pipe can be cleaned and coated in one day, but if the line is badly corroded, the time might be as long as three days. To clean and coat 10 miles of 18-inch pipe would require from 10 days to two weeks.

Cost of In-place Coating. The cost of cleaning and coating pipe in place varies with the size and condition of the pipe, the length and location of the line and the type of coating to be applied. In terms of unit costs per foot, the length of line is the most important factor. It is difficult to generalize when so many variables are involved, but the range of costs per foot will approximate the following figures:

Nominal Pipe Size	New Pipe	Used Pipe
4	$ .25 to .45	$ .30 to .45
6	.35 to .55	.40 to .55
8	.55 to .70	.60 to .70
10	.65 to .80	.70 to .80
12	.90 to 1.00	.95 to 1.05
18	1.25 to 1.30	1.40 to 1.45

Performance. In the early years, vinyls were used more extensively than other materials, but during the past three years epoxy base coatings have received wide acceptance. Coatings have been applied to new and old pipe in all types of oil field and gas pipe line service. Some lines operate at very low gathering system pressures, and others in injection service subjected to as high as 2200 pounds pressure. To illustrate the performance and economic advantages of in-place coating programs, here are some typical examples.

• **Case 1.** Approximately 39,000 feet of pipe in a sour crude gathering system was coated using a vinyl coating. Only the main stems of the system were coated and the expenditure was not more than $14,000. Prior to the coating application, a total of approximately $71,000 was spent on reconditioning the lines. The owner com-

Two coating plugs are ready to be placed into the section of pipe with coating material between them. Air pressure will move them through the line against controlled back pressure.

Progress of the coating plugs through the line can be traced with a radioactive cobalt 60 capsule. At the same time they can check the amount of coating material between the pressure plugs at any point.

pany gave the following figures for the cost of gathering oil in this field.

August, 1953	7c/bbl.
July, 1954	18c/bbl.
(Line Coated Internally)	
January, 1955	3.7c/bbl.

These figures represent all operating costs in the field; however, the major reasons for the high level reached in 1954 were related to corrosion.

Since the company received only 5 cents per barrel for gathering the oil, repairing the lines and preventing further deterioration changed a loss into a profit. As approximately 2000 barrels of oil is gathered daily, at the 7 cents figure, the yearly loss would be about $14,600. On the basis of 3.7 cents per barrel, the present profit is $9500 per year. The operating costs dropped from $360 per day in July, 1954, to $74 per day in January, 1955, yielding a savings of $286 per day. Since the cost of coating the line was $85,000, the work was paid out in 300 days.

• **Case 2.** A potable water line supplying domestic water for a camp and cooling water for a gasoline plant was coated with an epoxy type coating in January, 1954. This line consisted of 19,500 feet of 4-inch pipe. The line has since been inspected periodically and the coating found in excellent condition. Immediately after the coating was installed, chemical analyses were made using reference samples collected at the wells, at the plant and at intermediate points. No increase in soluble or insoluble iron has been found in subsequent tests. This was very important since one of the reasons for coating the line was to prevent contamination of the water with iron corrosion products which had been plugging the zeolite softeners at the plant.

• **Case 3.** In March, 1953, a test line was coated in a water-flood system. As a result of this test, when the flood was increased from a pilot flood to full scale operation in April, 1955, all pipe in the system was coated with an epoxy material. This system contains 35,000 feet of pipe varying in size from 2-inch to 8-inch. A small portion of the water used in the flood is produced water, the remainder being obtained from surface lakes. Fresh water is used to displace LPG from storage in salt domes and therefore becomes brackish. Water as injected is about 1.1 gravity. The system operates at 2200 psi.

Periodic visual inspections of the lines have shown the coating to still be intact. Water samples taken at the wells show no evidence of corrosion in the lines.

Internal Coatings Can Boost Throughput, Too. Although internal coatings were developed primarily for corrosion protection, they are now being used extensively for paraffin control. Perhaps the reason they are not in more general use is the fact that all the costs involved in removing paraffin are difficult to determine. The costs of steaming or running soluble plugs are usually available; however, in some cases, the labor involved in the actual steaming and in disconnecting the lines to get ready for steaming is hard to tie down. The indirect costs such as production and the inconvenience to the pumper and other personnel are more difficult to evaluate. However, in many cases it has been possible to show fast payouts in lines coated to reduce paraffin deposition.

One of the side effects that shows promise of developing into extensive use of internal coatings is the increased throughput obtainable with super smooth pipe walls. No actual figures are yet available on lines in gas or crude oil service, although a 3 percent increase has been unofficially reported in a 36-inch gas transmission line. Theoretical calculations based on accepted roughness factors indicate as much as 6 percent improvement is possible for 30-inch plastic coated pipe. Surface measurements show that steel which has been coated with plastic materials has a roughness factor in the range of drawn brass tubing.

Actual field data show an increased throughput of as much as 10 percent over theoretical. One good example is the case of a 6-inch cast iron water line. Before coating, 250 gallons per minute was being delivered at 105 psi. After coating, delivery rose to 560 gallons per minute at 60 psi.

Future Developments Promise Better Application. Improved chemical cleaning procedures which will speed up the operation are being developed. These chemicals will convert the pipe from an oil wet surface to a surface which will be susceptible to cleaning with water soluble materials. A phosphoric acid rinse should remove any trace of corrosion products and leave a phosphatized

Epoxy coating material is pumped from drums directly into the line to speed coating job.

surface, ideal for good coating adhesion. The phosphate coating will also inhibit underfilm corrosion at breaks or discontinuities in the coating.

Continuous improvements in coating materials, both in application properties and in chemical inertness, should improve the coating job. Materials are in the process of development which can be applied at low temperatures without worry about improper curing. These materials also show promise of being much more resistant to fresh water.

An internal holiday detector is being designed. This instrument may be run through the line to locate any holidays in the coating. Radioactive tracer capsules are now being used to check the progress of the coating plugs through the line.

An inside caliper driven by air or natural gas may be available soon for the internal survey of pipe lines. This instrument will record on tape the exact condition of the pipe interior. Deep pits can be located and repaired before they actually break through. If heavy scale is present to reduce the efficiency of the line, this will also be detected through the use of the caliper.

These are just a few of the many ideas which are being investigated. Perhaps some will not prove to be practical, but those that are satisfactory in field tests will assure a longer life for internal in-place coatings.

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About the Author

J. C. WATTS, technical representative, Internal Pipeline Maintenance Company, recevied a degree in chemical engineering from Mississippi State College in 1944 and attended graduate school at the University of Alabama. He formerly was corrosion engineer for the West Texas division of Humble Pipe Line Company. At present he is chairman of NACE Unit Committee T-2F on Internal Sour Crude Corrosion of Pipe Lines and Tanks.

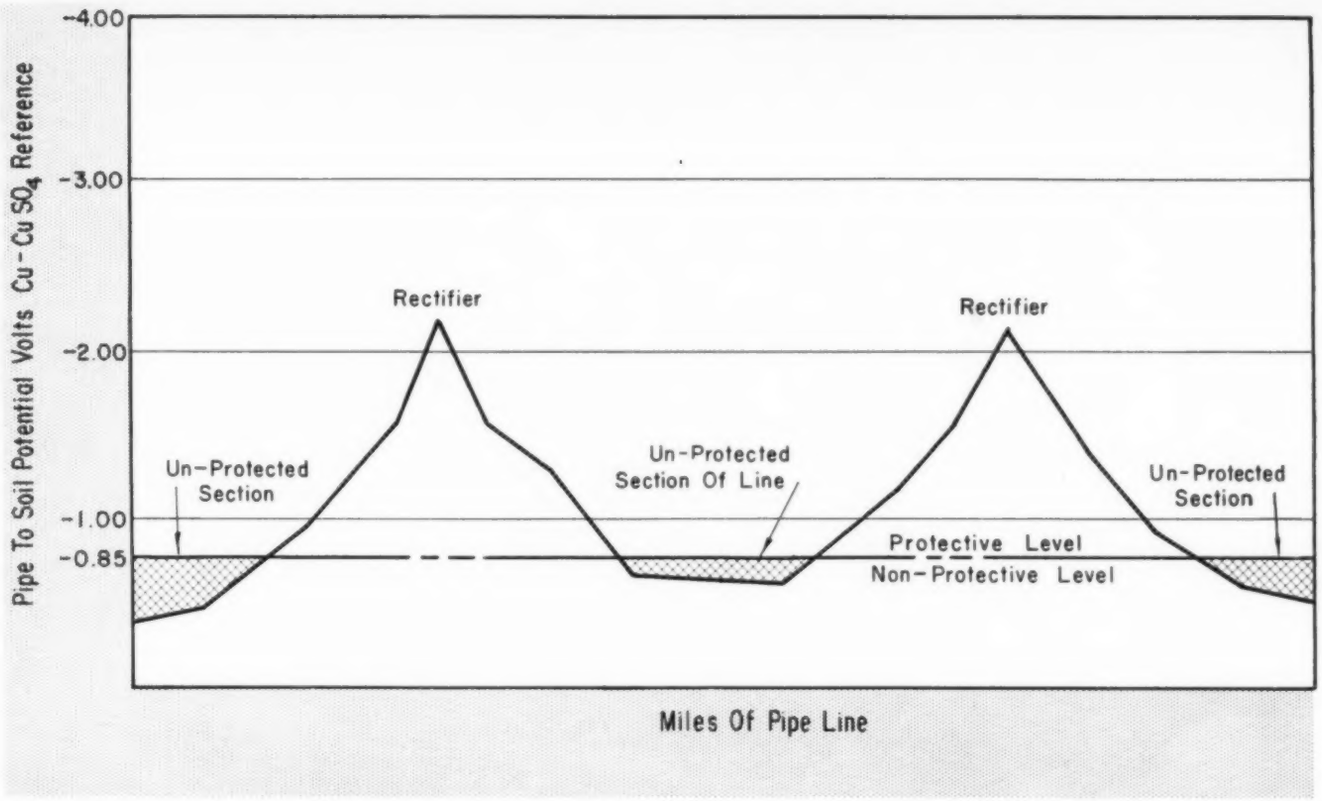


FIGURE 1—Spacing rectifier installations at too great intervals may leave sections of line without sufficient protection. Surveys show that the line is protected for some distances on either side of the rectifier but remote sections may be corroding.

Pitfalls to Avoid in the Design of a Cathodic Protection System

Many of the most common errors may be simply eliminated. Watching out for them will save money and give more efficient protection.

By WAYNE A. JOHNSON
Corrosion Rectifying Company, Houston

THERE ARE MANY written guides telling what-to-do when designing and installing rectifier and galvanic anode cathodic protection systems, but few point out common design errors to avoid. Here are some of the *dont's* to keep in mind when designing cathodic protection systems. They can be especially helpful to the pipe line man who may not be a corrosion engineer, but may have to work on cathodic protection systems.

The best installation is of course the most economical one—both in initial capital cost and future operating expense. A system which might be the least expensive to install initially could over a period of time, prove to be many times more costly.

In general, there are only the galvanic anode and rectifier types of systems in common use today. Both systems are flexible, to a degree. Frequently, either system would provide protection but usually an economic study based on local conditions will demonstrate the advantages

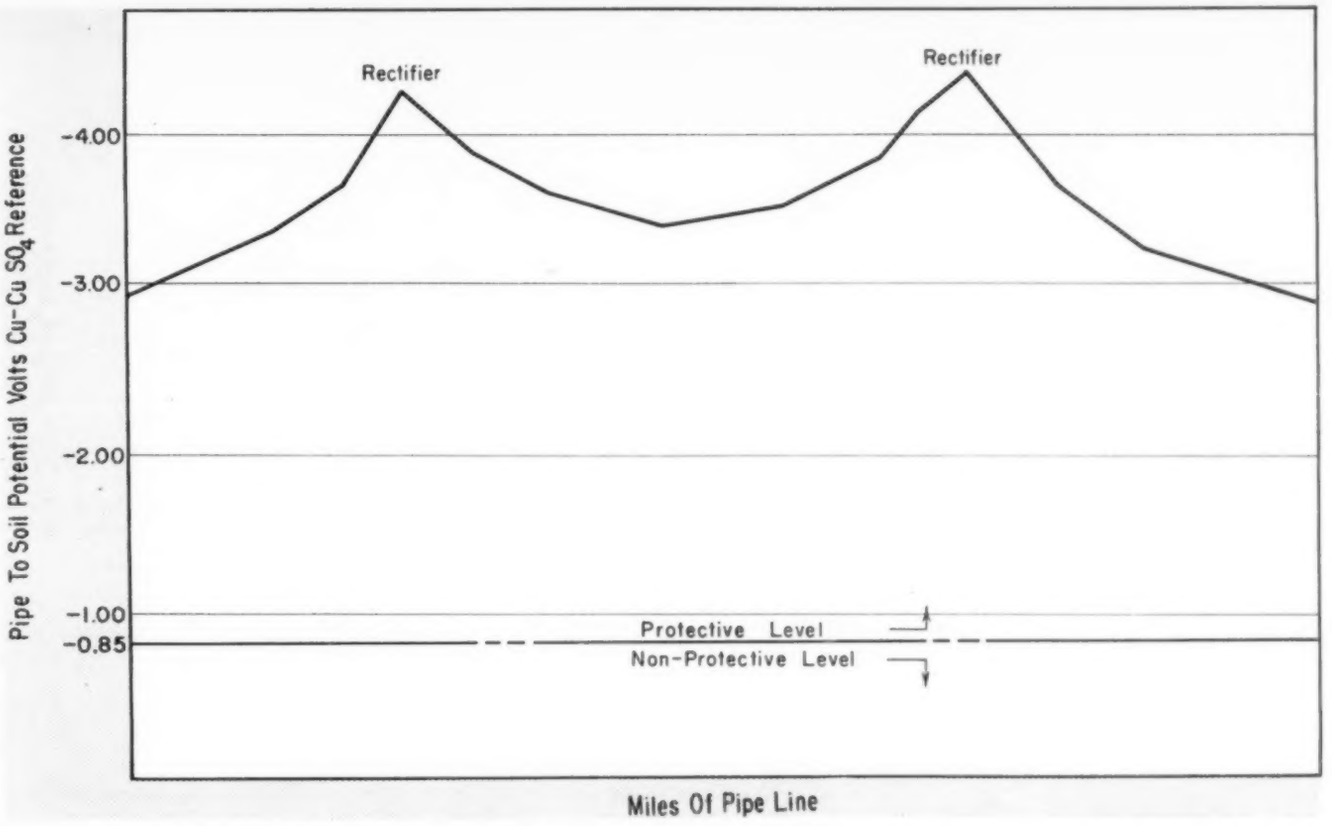


FIGURE 2—An excessively high level of protection may defeat the purpose of cathodic protection by damaging a coating. But even if it does not, it is a waste of power and money.

of one or the other for the specific problem at hand.

To design an efficient protective system it is necessary to know several basic facts about the pipe line facility including:

1. Length of pipe line, and size.
2. Condition of right-of-way soil (degree of corrosiveness).
3. Type and quality of pipe line coating.
4. Interference possibilities.
5. Availability of power.

Reliance has to be placed on known values, charts, graphs, etc. regarding current and voltage requirements for the specific conditions. After authentic information is available, the design engineer can apply it to the case in question with possibly an occasional rule-of-thumb.

Size Galvanic Anodes Properly. The successful use of galvanic anodes is predicated on the installation of proper size anodes at the correct spacing in soil of known electrical resistivity. In line with established expectancy curves, anodes produce specific amounts of electric current during their service lives. If the average required anode current output is calculated in advance, it is possible to choose an anode of proper weight so that the desired life expectancy will be achieved.

Keep these pitfalls in mind in the design of a galvanic anode system.

1. Too many anodes result in excessive current application and are unnecessarily costly. Too few anodes may make the protective system fall short of its mark.
2. An improper size anode will either result in short anode life, if soil is of low resistivity, or excessive anode life if soil is of a high resistivity. *Anode size must be tailored to fit the soil into which it is placed.*
3. Placing anodes too close to pipe, especially a bare pipe, will result in poor cathodic current distribution. Anodes should be at least five feet from a bare line.
4. Placing too many anodes in a group results in poor operating efficiency. If more current is required additional anodes should be distributed along the line. In general, about five anodes in a group provides a high level of efficiency.
5. Where the "hot-spot" type of installation is used, possibly using data from a prior survey, it is important to place the anodes exactly where the survey indicated the need.

Design Pointers for Rectifier Systems. The main reasons for the use of rectifiers are that they provide considerably more protective current than galvanic anodes, and at any required voltage. Whereas a galvanic anode might provide only 50 to 100 milliamperes a rectifier may provide from 50 to 100 amperes. Many galvanic anodes must be installed to equal the current available from one rectifier. Rectifier installations are more expensive, and should be engineered properly, installed correctly and regularly maintained. A poor design could well double the cost of a rectifier installation, which might normally be about $2000 - $3000 for a 60-ampere unit. Consideration must be given to the D.C. voltage and current rating of the rectifier, the A.C. voltage and phase, the proper size D.C. cables, the proper size graphite anodes as well as their spacing and location in the ground grid system. The anode wires must be connected properly to the main cable, and be 100 percent waterproof.

The proper amount of coke backfill should be placed

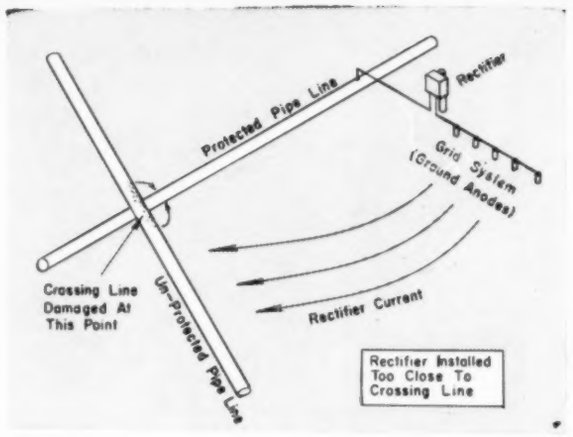


FIGURE 3—Locating ground beds too close to a crossing pipe line can lead to damage of the neighboring line. Cooperation is essential between corrosion engineers to insure proper bonding or other practical solution to these situations.

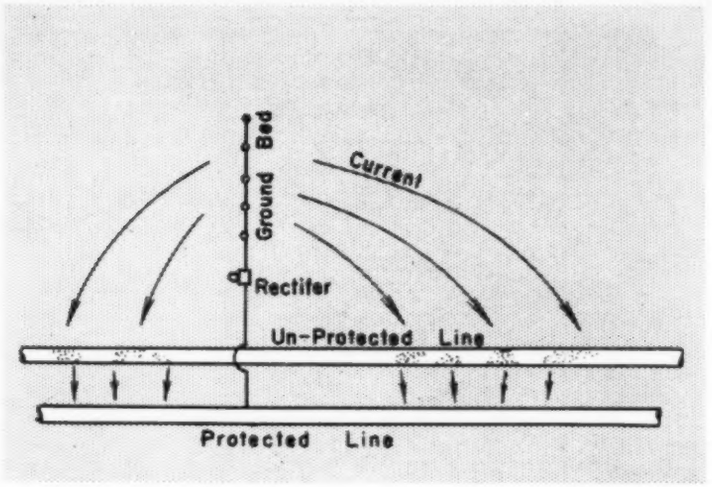


FIGURE 4—Installation of ground beds so that another pipe line is between the anodes and the line to be protected can damage the unprotected line. Relocation of the bed is often the best answer.

around each anode, and the anode system should be a proper distance from the pipe line.

Watch Out For These Pitfalls When Designing a Rectifier System.

1. Poor ground grid spacing results in high circuit resistance which is reflected in increased A.C. electric power bill.
2. Insufficient anodes (graphite) and insufficient coke backfill give the same result, and also result in short ground grid life.
3. If regular type graphite is used in salt environment, rather than the sodium impregnated anodes, the life of the anodes might well be lessened due to attack by chlorine.
4. If anodes are placed too close to the protected structure there will be inefficient "spreading" of the rectifier current.
5. Overdesign of the anode grid system, though providing greater life expectancy, will be costly.
6. Excessive rectifier current may damage the pipe line coating; also, excessive current output at one drain point represents uneconomical design.
7. Placing the rectifier system too close to "foreign" piping might result in damage to those lines and decrease protection for the subject line.
8. Proper selection of A.C. voltage will assist in minimizing the electric power bill. In line with this is the necessity of following code and company practices on the A.C. lead-in connections.
9. Use of air cooled rectifiers where feasible will reduce the original installation cost. However, where atmospheric conditions or hazardous areas command, the oil immersed type unit should be installed.

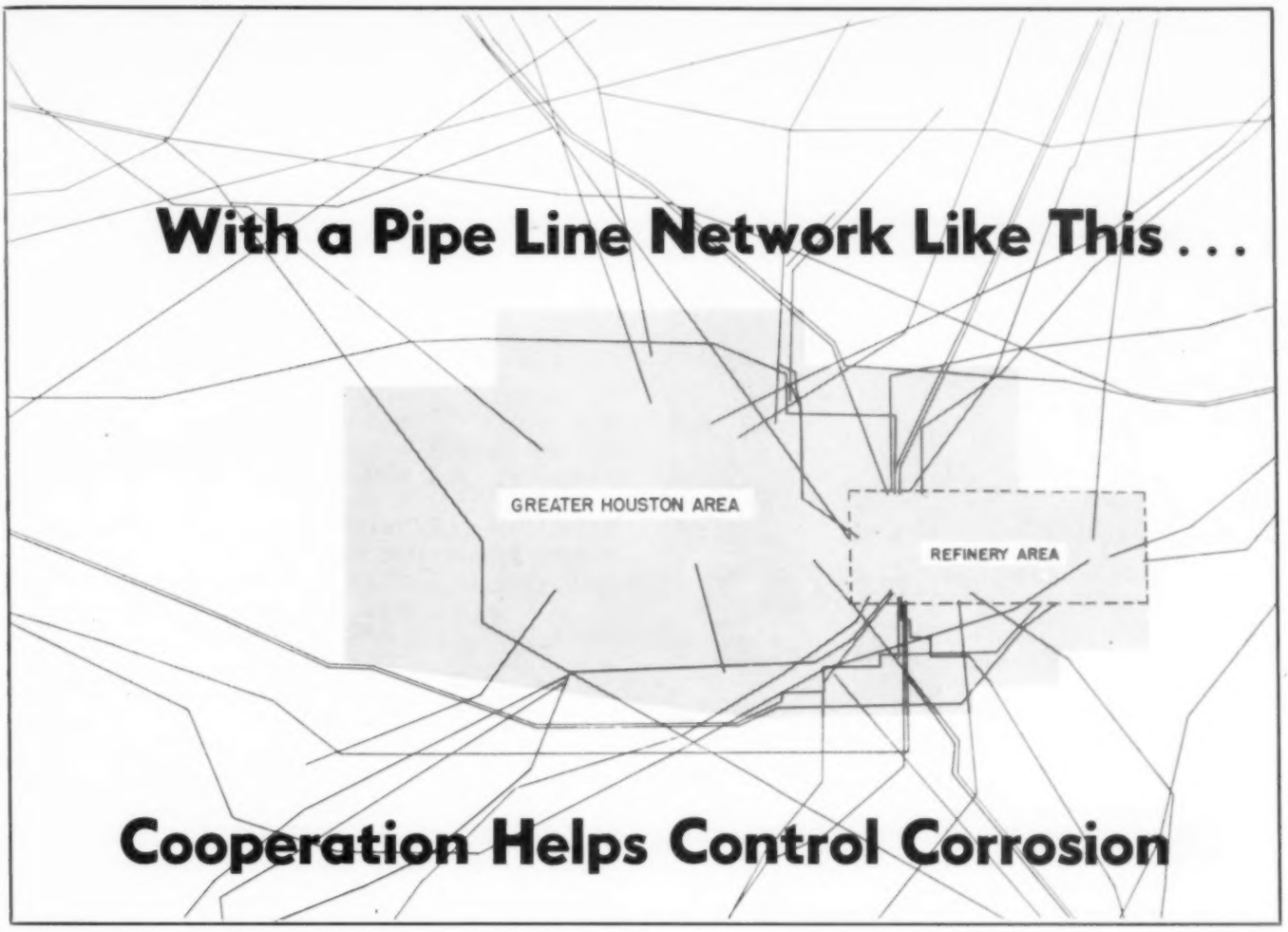
Avoid These Common Design Errors on Cathodic Protection Systems.

1. Failure to connect the D.C. leads with proper polarity. This will result in damage to underground metal rather than protecting it.
2. Placing rectifiers on non-conductive type pipe (insulated couplings, caulked joints, etc.) may result in damage to the joints unless they are bonded-over.
3. Failure to insulate other lines electrically which might be connected to the subject line will result in loss of applied current. Damage frequently occurs to the central gasket and sleeves and washers of flange insulation sets, thus these should be checked closely. Frequently bypass "bleed-off" and pressure gage lines are installed which make an electrical short path around insulated flanges.
4. Locating and repairing electrically shorted road casings, where feasible, may assist in reducing the current required for protection.
5. Last, but most important, is proper instrumentation and interpretation of the instrument readings. An instrument is only as good as the man using it.

There are numerous pitfalls along the path to good cathodic protection. The more experienced the engineer, the better the chance for success. Attention to some of the don'ts of cathodic protection design can be a helpful reminder. —**The End**

About the Author

WAYNE A. JOHNSON is president of Corrosion Rectifying Company, Houston. He has been actively engaged in corrosion work for many years, having received his early training as a corrosion engineer with The Texas Pipe Line Company. He has written numerous trade journal articles on underground corrosion and the use of rectifying systems. He is a graduate of Texas A. & I. College, Kingsville, Texas, and a veteran of World War II. He is a long-time member of the National Association of Corrosion Engineers, the Pipeliners' Club and other technical organizations.



By voluntarily working together in a control committee, cathodic protection is made more effective for all operators of buried lines.

By C. L. MERCER
Southwestern Bell Telephone Company, Houston

ONE QUICK GLANCE at the underground network of major transmission pipe lines and telephone cables concentrated in the Houston area will point out the need for close cooperation among corrosion engineers in such pipe line "centers." Seeing this need, 11 pipe line companies and the telephone company recently joined together in the Houston Corrosion Control Committee. The Houston group will exchange information on those lines within a 50 mile radius of the Harris County courthouse.

This isn't the first such committee formed. There have been several cooperative efforts in other cities. There may be a real need for still more. Perhaps these groups can profit from the early experiences of the Houston committee.

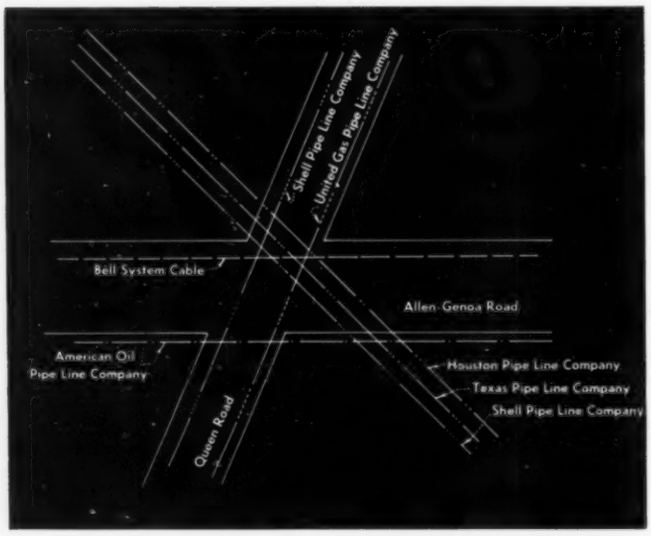
By working together corrosion engineers in the Houston area hope to avoid several major obstacles to effective corrosion control.

1. Interference Currents—A part of the current put into the earth by a cathodic protection system may be picked up by other subsurface structures in the vicinity. By careful design of any proposed protection system or unit, these interference currents lost to other structures can be limited to a very low value. But to design units properly, a knowledge of systems already existing in the area is necessary.

2. Competitive Current Drainage—This results when two adjacent protection systems raise their current output until maximum flow is produced in each. It is usually the result of interference currents. Competitive protection almost invariably increases the difficulty of protecting the systems and may even make it impossible for some systems to be protected adequately. Working together through the committee, cooperative studies determine the most practical and economical protective arrangement in any particular case.

3. Lack of Knowledge About Other Systems in Area—Most pipe line companies are willing to tell their neighbors what they intend to do to protect their buried lines. Many corrosion engineers working in the Houston

GULF COAST CORROSION CONTROL . . .



Road crossing near Houston points out the need for cooperation. At this point six pipe lines and a telephone cable make 15 crossovers.

area know one another personally and information can be exchanged readily.

But before the committee was organized this was not so easy for a new operator who intended to install cathodic protection on a new line entering the area or a long transmission line passing through. He had to spend considerable time to find out where neighboring structures were and who should be contacted so that the two systems might be coordinated. Lacking this information, he might have advised all operators, who he thought should be notified. As a result, unknown lines were often overlooked until trouble arose.

Now, by working through the committee, all operators concerned are notified and the new operator can learn about existing systems quickly and easily. In most cases the exchange of data is between those corrosion engineers who will have direct knowledge of and responsibility for the cathodic protection of these several systems. Information exchanged is thus accurate and complete. A complete and up-to-date map of the area showing major underground lines and systems is essential. Early in its organization the Houston committee decided that one of the first projects it must undertake was to make up a complete map showing lines and operators in the area. Using this, the committee is able to notify only those members concerned with a particular problem that might come up along their system. Other members who are not interested in the new installation or problem would not be advised. However, all new installations would be added to the map so anyone planning new installations could check it before designing an addition to an existing system.

ORGANIZATION OF COMMITTEE GEARED TO NEEDS. Widely differing methods of cooperative efforts are used in different areas. In the Houston group as in most areas, the representative to the committee is either a corrosion engineer or the one directly responsible for this phase of the company's operations. These men usually are appointed by the chief engineer or higher management so they are authorized to make pertinent decisions for their company. Such encouragement and support achieves a better spirit of cooperation.

HOW IS A COOPERATIVE CATHODIC PROTECTION COMMITTEE ORGANIZED? The first step is to decide whether such a committee is necessary. A careful study of a map or series of overlays of underground lines in a particular area will tell quickly whether such a group is needed and who should be represented.

A study of the map of the Houston area certainly showed the need for the committee. The majority of these lines are six inches or over. They pass through numerous suburban residential developments. Gathering, distribution and utility lines were not included. If they were, the map would have been virtually solid black.

After membership is obtained, the second step in organization is to draw up a set of "by-laws" to assist in proper functioning. These should define the purpose of the committee, the area of operation, membership, duties and tenure of office of its officers, meeting dates, and working procedures.

"Area of operation" can be somewhat indefinite if there is no existing committee nearby, but if others already are working, definite boundaries must be set to prevent overlap. Membership of the committee should include state or local government representatives, public service companies, pipe lines, and other industrial and commercial companies with underground property which could be damaged by corrosion or create conditions conducive to corrosion.

Meetings may be scheduled monthly, semi-annually or when the chairman has information of value to all members.

All information and data discussed at meetings should be confidential to the members of the committee and those present, according to the by-laws.

When problems of coordination are presented to the Houston committee, they are assigned a case number and maintained as a case as long as action warrants. Any member who finds a hazardous condition, from the corrosion control standpoint, or damage apparently due to corrosion and which jeopardizes the interest or property of any member of the organization shall report such condition at once to that member. Such information should also be reported to the committee secretary, who transmits such information to all members concerned. If no action is reported back from a member so notified within six months, the case is dropped from the active file.

—The End

About the Author

C. L. MERCER attended the University of Tulsa and Rice Institute before joining Southwestern Bell Telephone Company in 1933. Since that time he has served the company in various positions. In 1952 he was loaned to Western Electric Company to work on the Distant Early Warning System in Alaska; in 1953 he returned to the Houston division staff to work on corrosion problems. One of the original members of the National Association of Corrosion Engineers, Mercer currently is chairman of the Houston Corrosion Control Committee.

FIGURE 1—Earth auger equipment can be suspended from standard pipe line truck equipped with winch and A-frame.

FIGURE 2—Standard farm sub-soiler was modified to make wire plow for burying anode lead cable.

Pipeliners Put Farm Tools to Work

Here's how a gasoline powered saw motor was used to drive a heavy-duty auger on an A-frame truck for drilling holes quickly . . . and a modified sub-soil plow used to bury anode leads.

By M. J. OLIVE
Chief Corrosion Engineer, Arkansas Fuel Oil Corporation, Shreveport

SPECIAL EQUIPMENT is needed when a corrosion engineer has to test and install cathodic protection systems far from a home shop and often in remote areas. This equipment must be light, portable and do the job economically. Two basic units of equipment are needed to install cathodic protection units whether they are magnesium or zinc anodes or rectifier-type ground beds. These are an earth auger and a trenching device or wire plow.

To meet these field needs economically, an earth auger was built by adapting a nine-horsepower gasoline engine power saw motor to drive a heavy-duty spiral auger. This portable drill digs holes rapidly in any kind of earth. Assembled equipment can be mounted on a standard pipe line truck equipped only with a winch and A-frame. However, to dig holes as deep as 20 feet, a telescoping A-frame was built to provide the required lift. The winch raises and lowers the drill assembly as

FIGURE 3—Heavy-duty transmission reduces the power unit speed down to 100 rpm at the auger. Operator controls speed of the unit by a hand throttle on handle bar.

necessary. A high-strength swivel connected to the winch cable permits drilling without disconnecting the cable. Two men operate the power unit to guide and govern the speed of the drill.

Auger Easily Controlled at All Depths. A four-foot spiral auger with various lengths of pipe extensions proved best for digging deep holes. When the auger is full of dirt, it is raised by the winch, cleaned, and lowered again into the hole. The power unit and drilling transmission is pinned to the extension. Its position can be shifted as the auger digs deeper so operators work from a standing position regardless of the depth of hole.

Engine speed is reduced through a heavy-duty transmission to less than 100 revolutions per minute at the auger to provide sufficient digging torque. Speed of the power unit is controlled by a hand throttle on the handle bar. The engine is cranked by an automatic rewind starter similar to that used on most outboard motors. Equipment can be operated by inexperienced personnel.

Digging Unit Can Be Disassembled and Moved Quickly. Easily disassembled, the lightweight auger unit may be carried in an automobile or pickup to a district and then utilized with the local pipe line maintenance truck. Cost of the total assembly, including power unit, auger, swivel and extension is less than $750. It will drill holes up to 12 inches in diameter to depths of 20 feet. Shallow holes of small diameter for magnesium anodes may be drilled down to 5 or 6 feet in a matter of minutes without the use of a winch and A-frame truck.

Standard Subsoil Plow Modified to Bury Anodes Leads. Cathodic protection crews needed not only the proper drilling equipment but also a lightweight, readily portable means of burying anode leads. To meet this need, a standard farm subsoil plow was modified with a rolling cutter and a one-inch wire feed pipe welded to the butt of the plow from the top to the foot. It made a satisfactory cable plow. Wire feeds from the top down through the one-inch pipe into the ground. Once the wire is anchored to the pipe, the plow buries the anode lead some 18 inches beneath the surface. This plow can bury any size lead from number 8 wire to 2/0 cable at a minimum of cost and labor.

In operation, the winch line of the pipe line maintenance truck pulls the wire plow. The rolling blade cuts roots and breaks hard earth to reduce resistance for the foot of the plow. An operator rides on the wings of the plow to guide it. A trip mechanism raises the foot when all the lead is buried or if the plow hits some obstacle.

Cost of the modified subsoil plow is less than $150. Maintenance costs are negligible. Thus for less than $900, corrosion maintenance crews can be equipped completely.

Tools are light enough to be carried easily to field locations by available vehicles, yet have the strength and versatility needed to install practically any type of cathodic protection unit with a minimum of labor and maintenance.

These units have been used for installing magnesium anodes on pipe lines, service station tanks and plant piping as well as for installation of ground beds for rectifier systems on pipe lines and well casings. One set of equipment, now in service has operated for four years with low operating expense and maintenance.

The End.

About the Author

M. J. OLIVE is chief engineer of Arkansas Fuel Oil Corporation in Shreveport, La. A native of Alabama, he was graduated from Alabama Polytechnic Institute in 1948 with a degree in chemical engineering. He joined Arkansas Fuel Oil Corporation immediately after graduation as an engineer in the Corrosion section. He is active in both local and national activities of NACE. He is chairman of Sub-Committee T-2B-1 and a member of various technical committees.

1 Before a good job of coating can be put on pipe, everything else has to come off —so the first big job is that of cleaning the pipe. Dirt, mill scale, paint, mill varnish, old coating, oil and grease must all come off. Tightly adherent rust is not damaging, but no loose rust should be left at all. Watch to see that cleaning machines do not drip oil or water on the pipe.

12 Musts For a Good Pipe Coating Job

By MARSHALL E. PARKER
Consulting Engineer, Houston

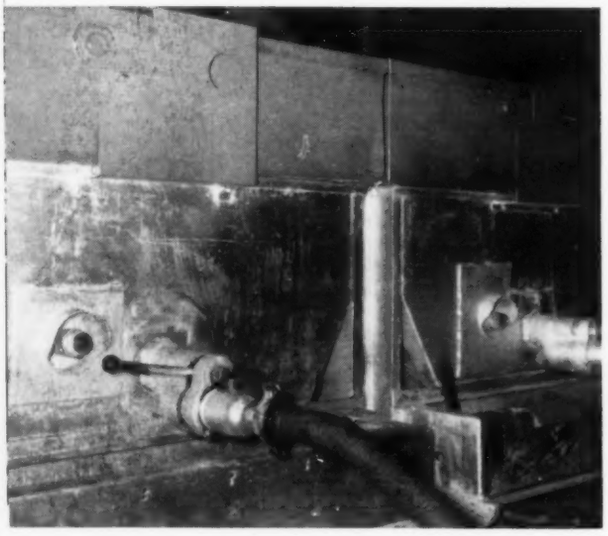
Application of a hot enamel coating system to pipe is really a manufacturing job. Careful attention to many details is required to get the best possible results. Each step in the operation should be closely watched; beginning with the storage and handling of materials, continuing during actual application, and including the handling of coated pipe until it is in the ditch and backfilled. Here are a dozen pointers to keep in mind—they are not new but they are important enough to bear repeating.

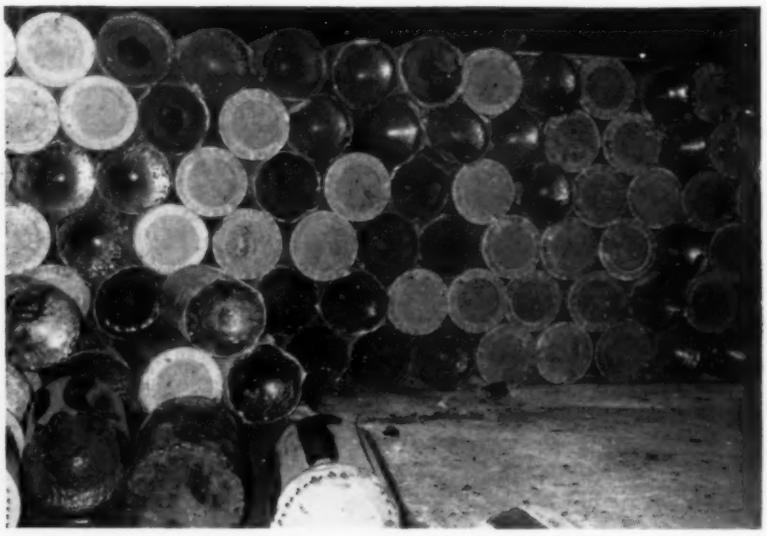
2 After application, primer must be allowed to dry long enough—but not too long. "Green" primer is too wet, contains too much solvent, and will make bubbles if hot coating is applied to it. "Dead" primer will not form a good bond. The simplest test is to scrape off a bit of primer with a knife, and roll it between the fingers; if it stains the fingers, it is too wet; if it will not form a ball, but crumbles, it is too dry; if it forms a ball which does not stain the fingers, it is just right.

12 MUSTS FOR GOOD PIPE COATING . . .

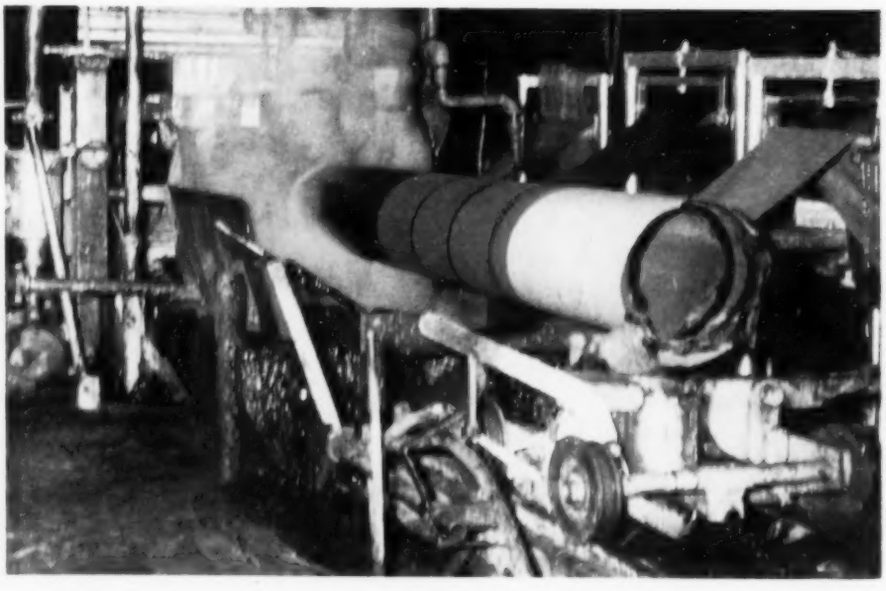
3 Felt, glass reinforcement, kraft paper, and all other wrapping material should be stored where it cannot absorb moisture. Never stack the rolls directly on a concrete floor, but support it on strips or pallets. Prevent deformation of the rolls by stacking them on end.

4 Enamel should be cut up on a clean, dry platform, under cover. Care should be taken to keep it free of all dust, dirt, sticks, and other foreign matter. It must be cut into pieces that are small enough for proper melting without excessive heating (follow manufacturer's recommendations—75 pounds is a good maximum size for most enamels). Open drums and cut enamel must be protected from rain and snow.

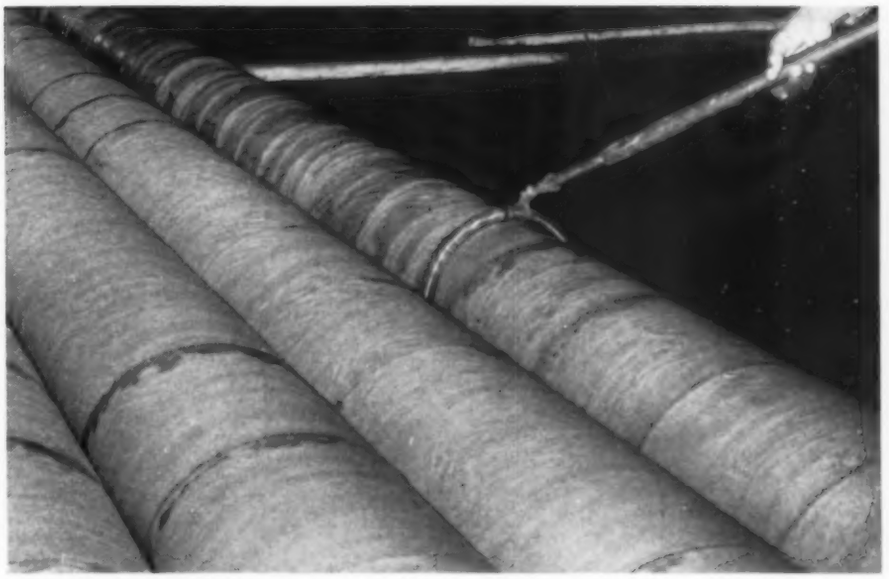




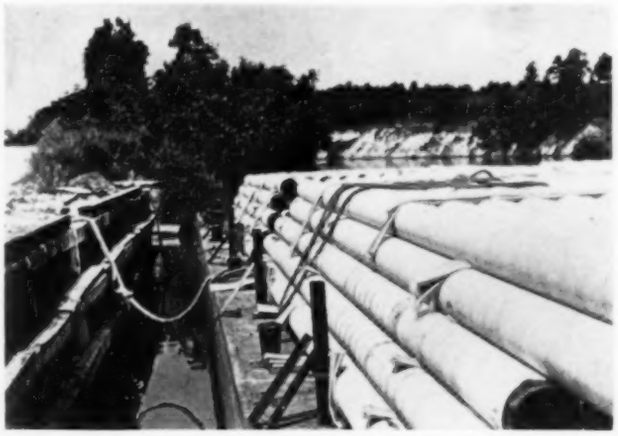
5 Enamel melting kettles should melt the material without subjecting any of it to excessive temperatures, which cause deterioration. Constant stirring is necessary to prevent settling of solid materials. Kettles must be cleaned after each melt, to remove the accumulation of filler and coke. Thermometers—either permanently installed or portable ones—should be used to help keep temperature within the range specified by the manufacturer.

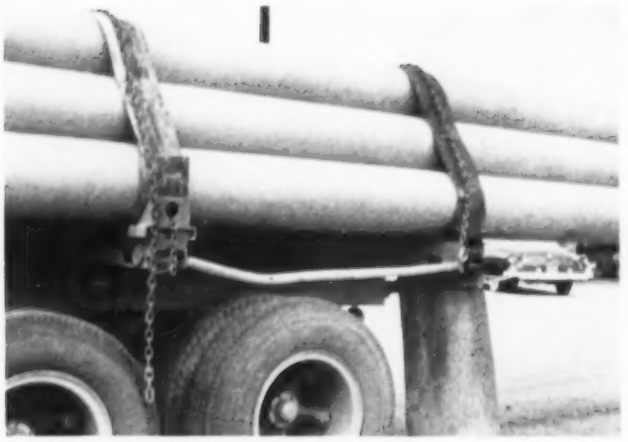


6 The molten enamel must be flowed onto the pipe at the proper rate and temperature to give the specified thickness. Application of glass reinforcement, if used, and of outer wrap is made at the same time. Correct lap is obtained on the wrapper by adjustment of feed angle and tension on the rolls. If kraft paper outer wrap is being applied, there should be a little "squeeze-out" of enamel between the laps of the felt in order to bond the paper.



7 When yard coating is employed, the holiday detector is a good check for errors in application techniques. Inspection at this point should never be considered final, for maximum effectiveness, it should be used again at the last possible moment—just as the pipe goes down into the ditch before backfilling. Always remember that the holiday detector, *alone*, is not a perfect judge of coating quality. It never speaks positively; but only negatively, telling where the coating is *not good*. When it is silent, it does not necessarily always mean that the coating is good. Visual inspection is necessary, too.





8 When yard coated pipe is loaded out for shipment or stringing, care should be taken to use adequate padding. The load should be secured to prevent any possibility of shifting in transit, whether by barge or truck.

9 Coated pipe is a delicate commodity—it should always be stacked on the uncoated ends, or with adequate support area to prevent mechanical damage. Here is an excellent example; each layer of pipe supports only its own weight. Stacking doesn't need to be elaborate, but careful attention should always be given to proper support and padding.

10 During unloading along the right-of-way, yard-coated pipe must be handled by the ends only. It should never be rolled off trucks. Care should be taken that it is placed where passing vehicles will not damage it. Coated pipe should be handled by the ends when possible.

11 When coated pipe cannot be handled by the ends, belt slings must be used. These should be designed so that no bolts or rivets protrude to damage the coating. Support should always be vertical to keep the edge of the sling from cutting into the coating.

12 Where coated pipe is left on skids, adequate padding should be supplied. This is a good example, however, low cost pads may be made from burlap bags filled with sand or sawdust.

About the Author

Marshall Parker is no newcomer to the readers of PIPE LINE INDUSTRY. He is a recognized authority on corrosion engineering problems, having written a series in earlier issues: He is a registered professional engineer in Texas and has been a consultant on pipe line corrosion problems since 1950. Much of his time has been devoted to NACE activities. Parker holds degrees from Sam Houston State College and Rice Institute.

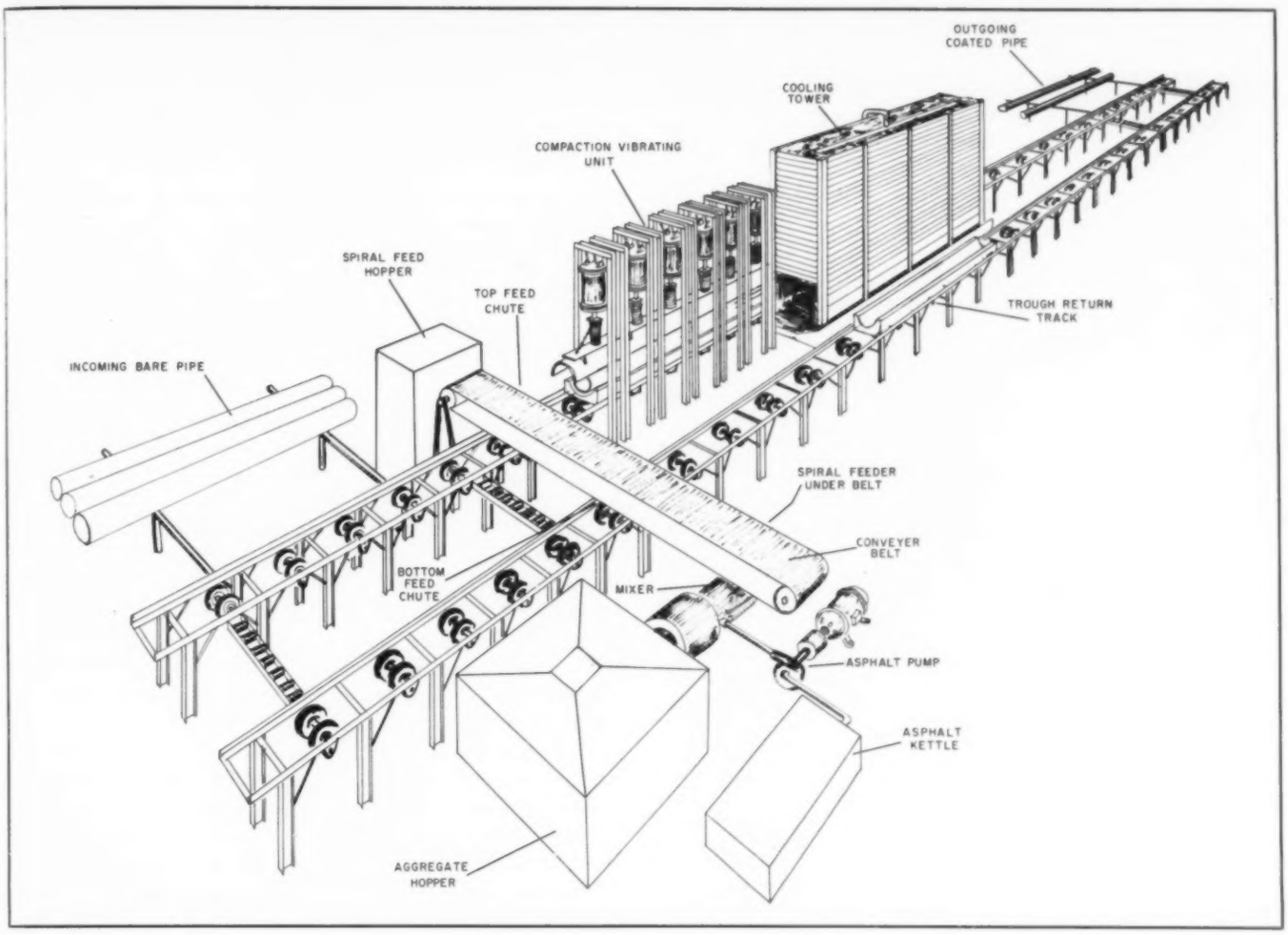


FIGURE 1—Artist's sketch of proposed plant for yard coating pipe with asphalt mastic weight coating by compaction-vibration method and controlled cooling.

Offshore Operators Eye New Coating

Early tests point up possibilities for new dual-purpose coatings on submarine lines. Costs are low . . . weight coating is flexible.

PIPE LINE ENGINEERS faced with the problems of constructing and protecting offshore pipe lines are showing a lot of interest in new equipment for compacting thick protective-weight coatings onto pipe. A machine developed and being tested by a Houston manufacturer produces a dual purpose heavy asphalt mastic coating by compacting the material onto the pipe using pressure and vibration in conjunction with controlled cooling.

This is the second important development recently in dual purpose coatings for submarine pipe lines. A rubber modified asphalt material containing glass fibers and mixed with an aggregate of ilmenite and barites compacted to the pipe under an outer wrap is now under test in South Louisiana (see PIPE LINE INDUSTRY, December, 1955, page 20).

A prototype of the proposed compaction-vibration plant shown in the artist's sketch has been tested using a variety of materials including asphalt and coal tar coatings com-

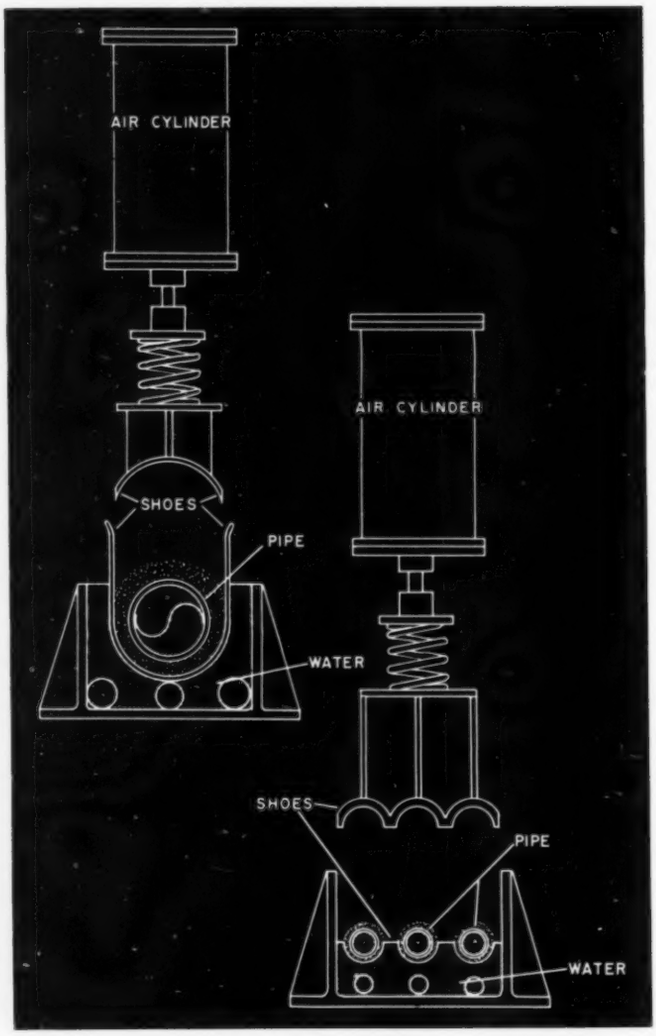


FIGURE 2—Using a single mold insert in the coating trough, one joint of pipe in nominal sizes of 6-inch or larger will be coated as shown at left. Several joints of smaller pipe may be coated at one time by substituting a multiple mold insert and compacting shoe. Coating of specified thickness is thus compacted on each joint and set by water flood cooling.

bined with aggregates ranging in weight from plain bank sand and crushed limestone to barites and ilmenite. The mixture is compacted upon a joint of cleaned and primed pipe by an air pressure operated form under vibration. A vibrating system installed both above and beneath the pipe trough helps bond the coating to the pipe and produce a more dense coating. Then, a water-flood system begins to cool the pipe and coating while pressure is maintained. Cooling is continued after release of pressure to "set" the coating.

HOW THE PROCESS WORKS

The empty coating trough passes under the coating feed hopper where it is partially filled with a quantity of blended material. This initial charge is equal to about one-half the amount required to coat the joint of pipe to specified thickness. Asphalt previously had been heated to about 400 to 450° F. and blended with the proper aggregates. Next, the trough moves across to the pressure unit track where a cleaned and primed joint of pipe is placed in the trough, spacers fitted near the joint ends, and the quantity of material necessary to coat the pipe completely is added on top of the joint.

Pressure and Vibration Form Coating. After the trough is filled with coating material it rolls under the compaction-vibration unit. There pressures of 1000 to 1680 pounds per square inch are applied by air cylinders mounted above the top molding shoes. At the same time electric vibrators on the top shoe and revolving hammers striking 400 blows per minute against the bottom of the trough vibrate the material to improve the bond and density of the coating. Each trough is flat on the bottom and may be fitted with inserts sized for the proper thickness of coating desired for the size pipe being handled. A web-like construction between the rounded portion of the trough and the bottom permits water-flooding of the hollow section to cool the coating.

Water-Flood Cools and Sets Coating. Vibration and pressure are maintained for 30 seconds to mold the hot material to the pipe. Then water is flooded inside the joint of pipe, around the top compaction shoe, and in the hollowed section of the trough. Pressure and vibration continue another 15 seconds. The top shoe is lifted and the trough and pipe are rolled into the cooling tower for an additional 2½ minutes of spray cooling.

Designers of the equipment believe that cooling the coating material while it is still under pressure produces the good bond to the pipe shown in initial tests. Cooling prevents softening or expansion of the coating after release of pressure so that a thick cohesive coating adheres to the pipe even without an outer wrap.

From the cooling tower the trough passes to the unloading rack where the section of pipe is removed. The trough is cleaned on the return rack and prepared for another joint. Freshly-coated pipe is ready for loading out within three minutes after coating is applied.

How Fast Can Pipe Be Coated? Based on experience gained in operation of the prototype plant, designers predict that a standard size plant such as the one sketched should be capable of an average coating rate of one joint of 6-inch pipe or larger every two minutes. Trough inserts and multiple compaction shoes would make it possible to coat a mile of pipe per hour in smaller sizes.

Extensive application tests have been made with a one-inch thick asphalt mastic coating on 8-inch pipe. Joints coated by this method have been bent in a conventional manner with no damage to the coating. Especially good bonding and physical properties have been obtained with a mixture of 15 percent-140 degree asphalt and clean bank sand. Weights in excess of 220 pounds per cubic foot may be attained with the barites and ilmenite aggregates. Coating thicknesses of from one-inch to five-inches may be applied practically.

Cost estimates are not complete, but early data show that equivalent corrosion protection plus weight could be obtained with the compacted asphalt mastic at less than the cost of a $\frac{3}{32}$-inch coating and wrap system. This would be considerably less than the cost of a regular protective system plus conventional weight coatings.

Two questions are yet unanswered by service tests: How well will the material hold up in marine environment, and what will be the effect of marine life, especially? First service tests will be watched with interest.

W. F. Fair

Pipe Line Men to Lead NACE in '56

W. H. Stewart

R. A. Brannon

New officers of National Association of Corrosion Engineers are experienced pipe line corrosion engineers.

As the National Association of Corrosion Engineers begins another active year at its Twelfth Annual Conference, the leadership will be made up of several men with long experience combating corrosion on buried pipe lines.

Taking office as president for 1956 is W. F. Fair, Jr., Tar Products Division, Koppers Company. W. H. Stewart, Sun Pipe Line Company is the new vice president and R. A. Brannon, Humble Pipe Line Company has been re-elected treasurer for 1956-57. Once again pipe line men hold the top posts in the association. The NACE was started largely through the efforts of pipe line corrosion engineers and its early leaders were men from the pipe line industry.

An active year in corrosion engineering is already underway, featuring several short courses planned on corrosion control work. A full program is planned for pipe line corrosion engineers during the 1956 meeting to be held at the Hotel Statler in New York, March 12-16. Here is the portion of the program that is of top interest to pipe line men.

NACE MEETING SCHEDULE

MONDAY, MARCH 12

Morning Committee Meetings
Internal Corrosion of Crude Oil Pipe Lines and Tanks; Prefabricated Plastic Film for Pipe Line Coating; and Minimum Current Requirements

Afternoon Committee Meetings
Anodes for Impressed Currents; Standardization of Procedures for Measuring Pipe Coating Leakage Conductance; and Protective Coatings Research

TUESDAY, MARCH 13

Morning Committee Meetings
Ribbon Anodes; Asphalt Type Pipe Coatings; Electrical Holiday Inspection of Coatings; Cathodic Protection; and Stray Current Electrolysis

Afternoon Committee Meetings
Galvanic Anodes; Internal Corrosion of Product Pipe Lines and Tanks; Gas Pipe Line Corrosion Problems (Organizational Meeting); Wrappers for Underground Pipe Lines; and Tests and Surveys

WEDNESDAY, MARCH 14

Morning General Pipe Line Symposium
Cathodic Protection of Certain, Semi-Marine Pipe Lines, B. J. Whitley, Jr., Tennessee Gas Transmission Company; Experiments Employing Diatomaceous Earth Filtration, Ivy M. Parker, Plantation Pipe Line Company; Performance Test on Pipe Line Coatings, H. W. Wahlquist, Ebasco Services, Inc.; and An Outline of Physical Theory on Underground Corrosion, Gordon Scott, Consulting Engineer

Morning Committee Meetings
Effects of Electrical Grounding on Corrosion and Resistance to Marine Corrosion

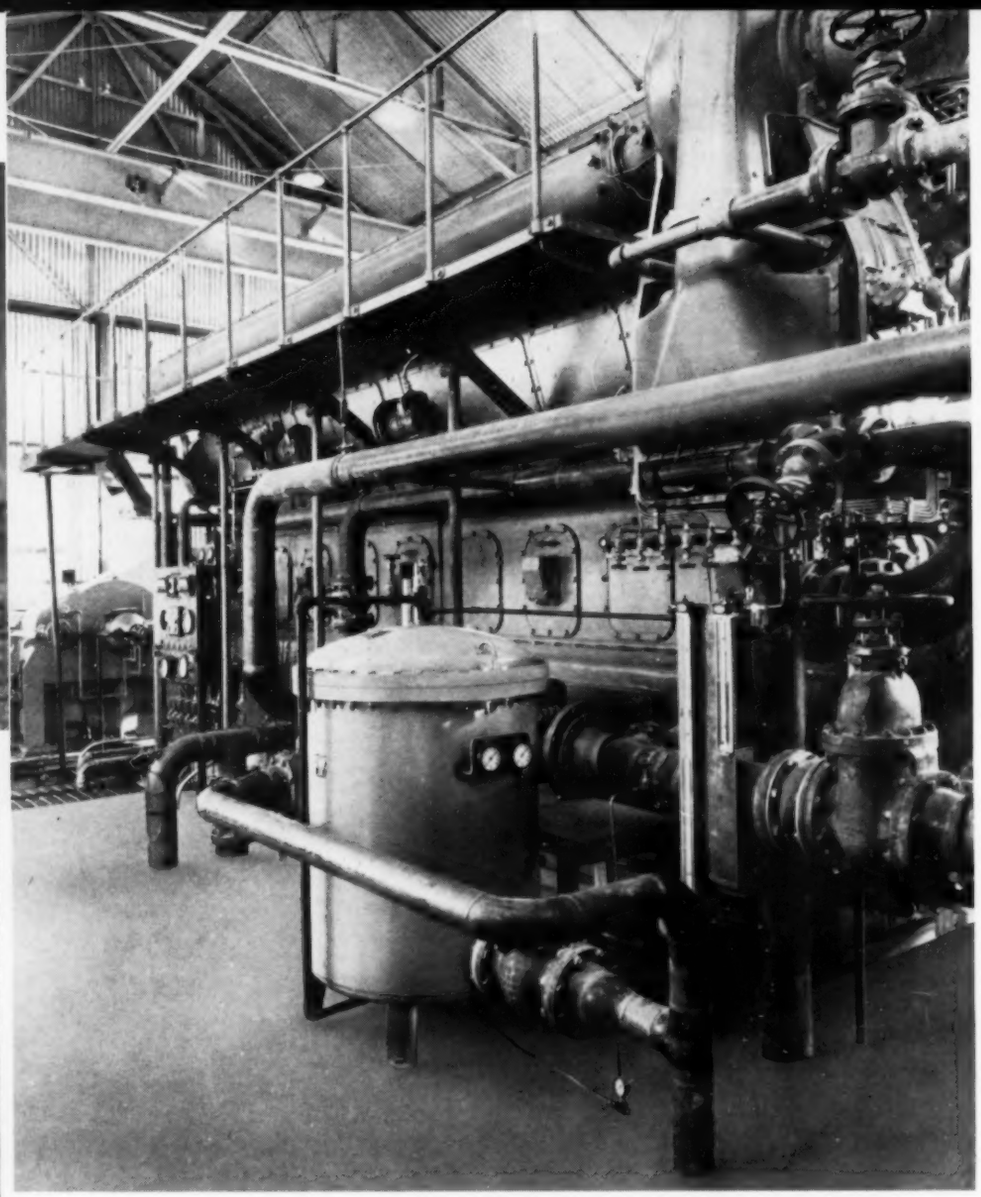
Afternoon
Pipe Line Group Discussions (Nine meetings scheduled)

THURSDAY, MARCH 15

Morning Cathodic Protection Symposium
Current Efficiency of Magnesium Used for Cathodic Protection; and R. C. Weast, Case Institute of Technology

FRIDAY, MARCH 16

Morning—Pipe Line and Underground Corrosion Round Table



This 16-cylinder, 4-cycle gas engine delivers 4550 hp through a speed increaser to a centrifugal compressor at Gulf Interstate's new Stanton, Ky., satellite station. Engine uses supercharging and turbocooling of intake air to attain fuel economies slightly over 6000 Btu per brake horsepower hour.

Watch Gulf Interstate's New Compressor Station

• This engine-driven centrifugal compressor station at Stanton, Ky., will be operated from 80 miles upstream.

• Operating tests of its many new features are being watched closely by the industry.

THE DREAM of manning a gas transmission line with unattended remotely-controlled compressor stations took a step toward reality when Gulf Interstate Gas Company recently put its new Stanton, Ky., engine-driven centrifugal station on the line. The 4550-horsepower station is now undergoing initial in-service tests. It is designed to operate by remote control from the Clementsville, Ky. station 80 miles away. As a completely unitized installation, it will be serviced by its own auxiliary accessory equipment.

Four-cycle gas engines and centrifugal compressors are not newcomers to the gas pipe line transmission industry. But here they have been combined into a unit for remotely controlled operation on main line service. The combination promises installation economies, plus lower fuel and maintenance costs.

Compactness in design is also an important advantage of the combination. The result is simpler, less expensive foundations than normally needed. Matching the gas pumping capacity with conventional compressors would require from 2 to 5 units.

Gulf Interstate's Stanton compressor station will have a capacity of over 500 million cubic feet of gas per day at discharge pressures up to 935 pounds per square inch.

A single 16-cylinder, 4-cycle gas engine delivers up to 4550 horsepower through a speed increaser to the centrifugal compressor. The engine is spark-ignited, supercharged and equipped with turbocooling. Fuel economy is slightly over 6000 BTU per brake horsepower hour.

One of the engine's important features is the utilization of turbo-cooling on manifold intake air. Intake air is allowed to expand through a turboblower system to increase substantially the air fuel charge to the engine. Horsepower is increased without the accompanying heat load on the engine. Manifold air intake temperatures are reduced without the high consumption of water often used on conventional systems.

How the System Works. Operation of the Stanton satellite station can be completely controlled by direct wire communications from Clementsville. Control equipment provides for these functions: opening and closing of engine loading valves, starting the engine, placing the engine-compressor unit on the line, controlling the engine speed for setting station discharge pressures, removing the compressor from the line and shutting down the engine. Essential operations are telemetered to the main station. Both visual and sound alarms signal any malfunctioning on the main control panel at Clementsville and, when necessary, automatically shut down the unit.

Here's a step-by-step description of how the system operates . . .

To Put the Stanton Station on the Line . . .

Controls at Clementsville first open the loading suction gate.

- Blow down valve is normally open while the station is off the line.

Blow down valve is closed.

- Line pressure builds up in the compressor case.

Discharge valve closes.

- A permissive start switch is actuated to energize engine starting circuit.
- Engine auxiliaries such as the oil circulating pump are placed in service to circulate oil from the gear sump of the speed increaser through a gear oil heater.
- Oil level is maintained automatically in the seal oil tank for centrifugal compressor shaft seals. If the level drops too low, additional oil is diverted automatically from the gear sump.

Only when all auxiliaries are functioning properly and loading gates set correctly does the main start switch actuate the engine starting circuit to begin the engine starting sequence.

- Automatic control circuit of a 3-way air-solenoid valve is energized to admit starting air to the engine.
- Engine picks up speed and runs for a set purge period.
- Ignition is turned on.
- Fuel gas safety shutoff valve and starting fuel valve are then opened to admit fuel to the engine.
- After engine fires and reaches partial speed the engine speed control switch energizes the control circuit of the main fuel gas valve.
- Starting air is shut off and the main fuel valve opens.
- At partial engine speed, gas pressure is admitted to the diaphragm of a three-way valve in the control air line; to a shut-down cylinder on the gas regulating valve, and to a pneumatic link in the governor control mechanism.
- With the gas regulating valve in operation and control air pressure on the pneumatic engine governor, the engine idles through a warm-up period.
- Engine speed then is regulated to a pre-set value by an automatic timer.
- When the engine is running at speed, loading gates are opened to load the engine. The loading discharge valve opens first, then suction valve.
- Discharge pressures set on the control board at Clementsville are maintained automatically by the engine speed governor. Discharge pressures may be varied by regulating engine speed.

To Shut Down Satellite Station . . .

Pushing the "stop" button at Clementsville initiates the shut-down sequence.

- Stanton's main fuel gas solenoid is de-energized closing the main fuel valve.
- The safety fuel gas valve then is closed; engine speed drops off.
- Line suction and discharge valves are closed.
- Ignition is grounded, cutting off the engine.
- When suction and discharge valves are fully closed, the blow-down valve is opened to blow down compressor.

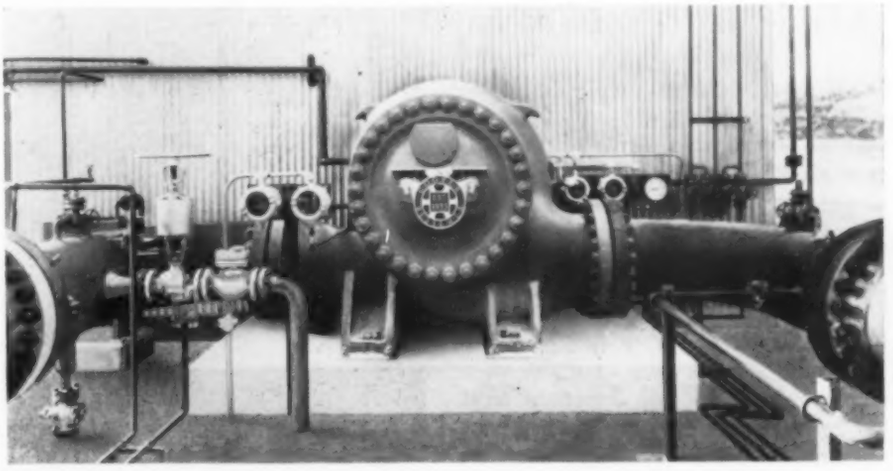
Design of Controls Provide Maximum Safety. In the event of an operating hazard at Stanton, safety devices shut down the engine, close the side gate valves, and blow down the yard piping. An alarm is sounded and warning lights come on at both Clementsville and Stanton.

Should a break occur in the pipe line or a fire start in either the supervisory or main building, the engine could be started again only from Stanton. Remote starting from Clementsville is possible should dangerous engine speeds, low oil pressure, high discharge pressure, or high temperatures force an automatic shut down.

Operation of the satellite station can continue following the sounding of alarms at both Clementsville and Stanton for several minor conditions. In this way the station remains on the line in spite of the loss of fuel gas heater pilot, low oil level, loss of water pump seals, low water level, low air pressure or low seal oil level. Loss of AC power, loss of the external power supply, gas surge in the compressor, a variation in discharge pressure of 5 pounds per square inch from set values, or loss of telephone lines also will turn on trouble lights.

Stanton's control system telemeters variation in suction pressure, discharge pressure or starting air pressure, variation in engine speed, and setting of pressure discharge controller to Clementsville. Although Gulf Interstate's satellite station is designed for normal operation under remote control, it can be operated manually at Stanton. A switch panel permits manual starting, with or without electric power from an external source. REA system is the regular source of power to the station.

—The End



This centrifugal compressor is driven by a gas engine inside the station and is capable of handling over 5 Mmcf of gas per day at discharge pressures up to 935 psi.

THE TRUCKS await orders prior to hauling gas into Florence, Kan., during temporary line shutdown.

Trucks Transport Gas During Line Shutdown

Supplying emergency gas by truck was successful in this Kansas town. Here's how it worked.

SUPPLYING A SMALL community with natural gas during a temporary supply line repair shutdown can pose some real problems. And a solution often has some surprising features. Cities Service Gas Company and Citizens Gas Company recently hauled gas by butane truck for six hours into Florence, Kansas, to maintain a gas supply for 1000 customers.

Cities Service's main 26-inch line from Hutchinson to Elmdale, Kansas, was shutdown while pig traps and launchers were installed. The first step in the emergency supply plan was to install five joints of 26-inch pipe at the Florence town border station, five miles north of town. At 600 pounds of pressure, the five sections held a two-hour supply of gas. This temporary storage capacity provided for a possible flat tire or other trouble encountered by the trucks.

In addition, Citizens Gas' five-mile service pipe line into Florence held enough gas to supply the town for an hour and a half to two hours. Pressure on this line was 150 pounds per square inch.

Two commercial butane trucks did the hauling from the Elmdale gate. One truck had a capacity of 6000 gallons and the other 5500 gallons. The larger truck carried gas under 250 psi, the smaller at 210 psi. Gas was hauled to the edge of Florence and put into the distributor's line just ahead of the intermediate regulator.

The drop in pressure within the trucks made it impossible to empty them completely. Even so, the larger truck held one hours' supply of gas, the smaller one held a 45-minute supply. A round trip to the Elmdale gate 20 miles away required 75 minutes. While both trucks were gone, gas was drawn from the five miles of distributor line.

The pressure in the five-mile distributor's line was still at 80 psi when the shutdown was completed. Gas in the temporary storage system was still untouched. The operation was a success.

"Gas by truckload" had been used twice prior to the Florence incident. At Vinita, Okla., and at Sylvia, Kansas, only a week before the Florence operation.

ACKNOWLEDGMENT
Reprinted from the *Dispatcher*, December, 1955.

EMERGENCY STORAGE was provided by five sections of 26-inch pipe. At 600 psi, they held two-hour supply.

Johns-Manville TRANSHIELD® ASBESTOS PIPE LINE FELT

goes on fast, restricts soil stress, cuts maintenance

Transhield Asbestos Pipe Line Felt meets the need for a felt that is economical yet effective in all ordinary soil conditions.

Designed for easy, high-speed application by modern machine methods, Transhield is strong, light in weight, and highly tear-resistant. Longer length rolls increase application speeds since fewer stops to replace rolls are required. Transhield's highly desirable characteristics are attained through an innovation in felt construction. It consists of a lightweight coal-tar saturated asbestos felt, reinforced with continuous glass yarns parallel-spaced on ¼" centers.

Because Transhield is a continuous membrane between the pipe line enamel and the soil, it works effectively toward preserving a continuous protective film of enamel on the pipe. It guards the enamel during construction and, after installation, it reduces the cold flow of the enamel, acting as a surface barrier to restrict soil stress.

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JOHNS-MANVILLE JM PRODUCTS **Johns-Manville PRODUCTS FOR PIPE LINE PROTECTION**

Lone Star Trains Leaders By Passing Authority Down

This new organizational plan gives senior executives more time to plan for the future.

By M. L. BIRD
Lone Star Gas Company, Dallas

THERE IS nothing more important to a company than its future. To assure this future objective planning is necessary.

The lack of adequate planning is usually the result of top executives becoming so occupied with detail matters that they are unable to concentrate upon the future needs of the business. Consequently, they have failed at times to utilize the knowledge of their experienced people. If top executives are to find time for the planning of company objectives and be assured those objectives will be achieved, they must first develop a sound plan of company organization, have fully qualified personnel in all key positions, and provide effective methods of control.

Functional and regional plans of organization present the most adaptable features for the gas distribution business. The functional plan is the type most commonly found in industry. Unquestionably this type of organization is the most practical for smaller companies where operations are less complex. However, at a certain point of expansion, it becomes difficult to maintain effective management control through a single executive or small group of executives.

The regional system is one in which a divisional executive has charge of all company activities within a given geographical area, and is held fully accountable for operations as though this unit were a separate business.

Recently, Lone Star Gas Company found it advisable to revise its organizational structure and decided on a compromise between the functional and regional plans of organization. While finding it impractical to go the whole way toward regional management, it felt that by setting up its organization on a functional basis that a more effective use could be made of the regional principle for decentralizing certain managerial functions and responsibilities.

Lone Star Gas Company, as is the case with most integrated natural gas companies, has three basic functions —the production of gas, the transmission of gas from field to city gate, and the distribution of gas to burner tips within the city.

Its distribution is divided into three major divisions, serving more than 700,000 customers. General Division of Distribution, which is under the writer's supervision, serves more than 375,000 customers in 394 towns in Texas and Oklahoma, embracing an area of approximately 200,000 square miles. This division is divided into five regions and subdivided into 57 districts.

The regions are under the direction of a regional manager aided by a staff organization in the fields of sales and promotion, engineering, and accounting.

The operating district organizations are under the supervision of a District Manager, who reports directly to the Regional Manager. Because of the wide variation in size and geographic influence, the district organizations are classified into three operating groups for the purpose of providing a most economical pattern of organization.

The Class A District is the large operation, serving approximately 12,000 meters or more. Because of its large scope of operation it is more highly departmentalized than the B and C Class Districts, thereby requiring a larger number of supervisors upon whom the District Manager must depend in carrying out the company's objectives.

About the Author

M. L. BIRD, Lone Star Gas Company vice president, directs gas service and maintenance operations for some 390 Texas and Oklahoma towns making up the company's General Division of Distribution. He started his career with Lone Star in 1925 and has held important engineering and supervisory assignments with the company. He is a veteran of World War I and during World War II was commander of Group 19, Civil Air Patrol, and auxiliary to the Army Air Force.

The Class B District organization usually serves from 6000 to 12,000 meters. The pattern of this type of organization of course varies somewhat from the A Class District. Due to being more limited in its scope of operations, the pattern of organization is more centralized, making it necessary to assign broader responsibilities to both the supervisory and non-supervisory personnel.

The Class C District is the smallest of the district operations and consequently the pattern of organization differs considerably from that of the other classes of district. This size district handles approximately 1500 accounts, but seldom will exceed a maximum of 3000.

After the design of the new organization plan had been determined, the first step in implementing the plan was to prepare a master chart of the company's organization as a whole, subdividing it only into the major divisions.

The next and perhaps the most important charting is that of the various organizational components. This serves as one of the most essential tools for control as it is planned in a manner to show the composition of each organization component. These charts are designed on a functional

basis and are subdivided into the various departments. Job classifications, with a space for the number of employes in each classification, are grouped under each department according to the pattern of organization which has been approved by general management. In addition to including the complement of personnel of the various classifications, provision is made for the listing of the authorized number of automotive equipment and other mobile equipment, such as trenching machines, back fillers, air compressors, etc.

To facilitate control over the organization aspects of management and to assure that all responsible administrative heads clearly understand their responsibility, the company prepared an Organization Guide and placed it in the hands of this administrative group. A complete Guide, of which only a pertinent portion is issued to any one executive, consists of:

1. A key map of the company organization and its principal subdivisions.
2. An Organization Directory listing such information as executive personnel by location, towns served, number of meters, and other pertinent information on the district organizations and their subdivisions.
3. Functional organization charts on each organization component which general management has approved as to the pattern of organization and complement of personnel and automotive work equipment.
4. Job classification giving the principal duties and responsibilities, and training experience requirements. In the case of supervisory employes, the job classifications include such additional information as the scope authority, accountability, etc.
5. Salary ranges on all non-supervisory employes, and on all supervisory employes below the rank of those to whom an Organization Guide has been issued.

The realignment of the company organization was dictated by its rapid growth in the last decade, and its main objectives were to further delegate authority in order to lighten the load of detail imposed on top management, and to more clearly define job responsibilities.

As an example of the streamlining effects of the reorganization, the following changes in the writer's headquarters staff are cited. This staff had previously been organized into six departments identified as follows: Engineering Department, Industrial and Commercial Department, Merchandise Department, Dealer Assistance Department, Meter Maintenance Department, and Supervisor of Building and Maintenance. All of these departments had been operating independently of each other with each reporting to the divisional vice president.

Under the revised plan, these six departments were consolidated into just two—the General Sales and Promotion Department, and the Distribution Department. The consolidation at one stroke reduced by four the number of department heads reporting to the staff head.

Similar revisions were made on down the line in the regional and the district organizations. Like some key management personnel, due to the rapid growth of the company, Regional Managers were burdened with too many detailed responsibilities and had insufficient authority to accomplish their assignments. Consequently, as previously stated, the regional organizations were divided into three staff sections: Accounting, Distribution, and Sales and Promotion.

Space will not permit the detailing of the many changes that were made in the reorganization but it is well to mention one highly important matter that most gas company executives have to deal with, and that is control over expenditures. In an organization like Lone Star, it is necessary that regional and district managers have some authority to incur expenses in ordinary operations, and to make contributions and donations. It is equally necessary for top management to hold a tight rein on this function. A satisfactory arrangement was accomplished by granting headquarters staff officials authority to spend within certain stated limits. Down the line this authority was delegated in amounts commensurate with the regional and district operations of each locality.

The variations that will be found in the approved district organization components of comparable size, indicate to some degree the flexibility of the basic organization pattern that was developed for the three classes of the district organizations described. Due to the constant changes that are taking place in the business it was considered important that all controls should be designed to allow changes to be made in an organization pattern with reasonable promptness in order to meet the current needs. An attempt has been made to inject a degree of flexibility in the control procedures over organization by broadening the duties in certain of the job classifications and by permitting a degree of variance from the established organization patterns based upon the volume of work.

For example in a small Class B District the typical pattern of organization provides for a storekeeper and/or warehouse clerk, or both, depending upon the work load. Under circumstances where the volume of stores work over a period was found insufficient to require 50 percent or more of one man's time, a storekeeper could then not be justified. Recommendations would therefore be made for the authorization of a warehouse clerk with joint assignments for clerical duties in either the Shop Department or the Commercial Office. In this instance manpower has been kept consistent with the current needs and the expense kept within the proper limits.

Some essential steps have been checked which seem advisable in building the operating structure of a company in order that responsible executives can hold it to its desired character.

As a business expands, the necessity for positive means of communication between top management and line management becomes more urgent. Size has its disadvantages as well as its advantages. To prevent the disadvantages from outweighing the advantages, the organization plan must be continually studied and frequently revised in an expanding company.

The natural gas industry has grown into the stature of big business. In the earlier days, all authority and most administrative functions were concentrated in the head office. But in the complexities of this day, decentralization is the slogan as expanding companies seek an effective pattern of organization that will rescue their top executives from a multiplicity of detail in order that they may turn their energies to the policies and planning which shape the character of their enterprise. **—The End**

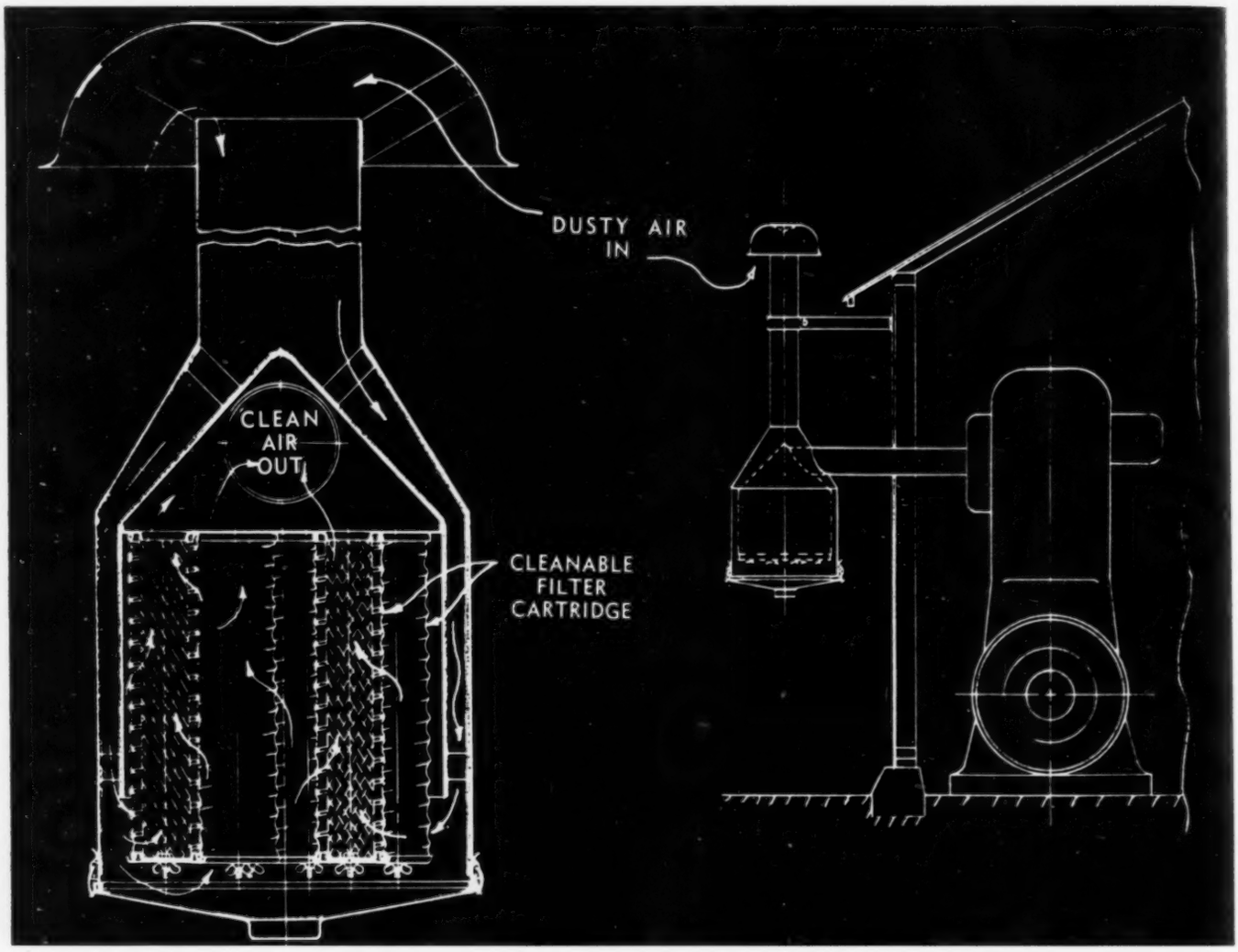

FIGURE 1—Modern air intake silencer and filter installation with high, safe air intake and simple method of replacing filtering elements with cleanable spare cartridges, developed by aviation recently. Cartridges have very low resistance on the intake air. To clean filter, unclamp the bottom, slip off cartridges and replace them. Dirty ones are cleaned at operator's convenience.

How to Select Filtering Equipment

Here's an important step toward reliable economical operation and low maintenance costs on large internal combustion engines.

By CHARLES A. WINSLOW,
President, Winslow Engineering Co., Oakland, Calif.

APPLICATION of filtering equipment to large internal combustion engines, such as used on pipe line pumping installations and oil field work in general, is one of the most important considerations for insurance of reliable, economical operation and low maintenance costs.

First and most obvious need, is a filter for the air intake. Even with filtering efficiencies well over 90 percent on the intake air filter, problems with ground-out bearings, etc., brought about the need of an oil filter to protect engine bearings from grit picked up from the bottom of the crankcase and pumped into the crankshaft bearings. Next come full-flow filters; filters applied between the lubricant pump and the engine bearings, with all oil going through the filter in normal operation.

Consider, for instance, a track-laying tractor operating in soft dirt, in dense clouds of dust and, in some early designs, with the tracks actually throwing the dirt into the air intake. Under these conditions, even a 99 percent air cleaner is not good enough to prevent dirt from entering the engine cylinders. If the engine actually sucked in ten pounds of dirt a day, easy under certain conditions, and the filter was 99 percent efficient, at least 1/10 of a pound of dust is actually drawn into the engine every day and ground down past the piston rings, lapping the cylinders, rings, pistons, etc., on its way to the crankcase. Such contaminated lubricating oil, re-circulated into all the engine bearings,

gears, tappets, etc., is a perfect lapping compound.

It is evident that dirt should be stopped before it enters the air intake of the engine, and that any that gets by the air filter should be prevented from recirculating in the crankcase with the lubricant, necessitating not only efficient air filters but also efficient full flow oil filters. An efficient breather filter is also a must on the engine crankcase to stop dust at that source.

Pipe line pumping stations are far removed in operations from agricultural or industrial equipment operating in soft dirt.

But dust storms and dust in the air, to a lesser degree, equally are hazardous to pipe line pumping stations where great quantities of air are drawn into the air intake on the engine. Unless stopped by an efficient air filter, dust can cause the same general type of lapping and grinding in the cylinders, and eventually in the crankcase, unless it is filtered out of circulation.

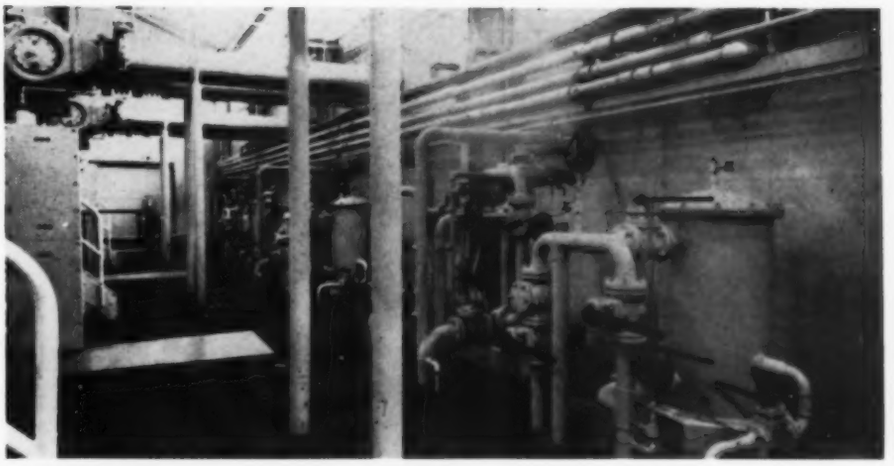

FIGURE 2—Trans-Mountain Pipe Line Company station at Kamloops, Canada, equipped with filters and lubricating oil filters.

There are several well-founded basic principles that apply to any type of engine operation; one is, if the air intake is high enough, it generally can get above most of the normal types of dust blowing on the ground. An intake at ground level would take in any dust blown by the slightest movement of air; an air intake 100 feet in the air would collect dust only in the event of a dust storm or some other abnormal condition. A fair compromise is some place between ground level and a high location, with the intake as high as practical.

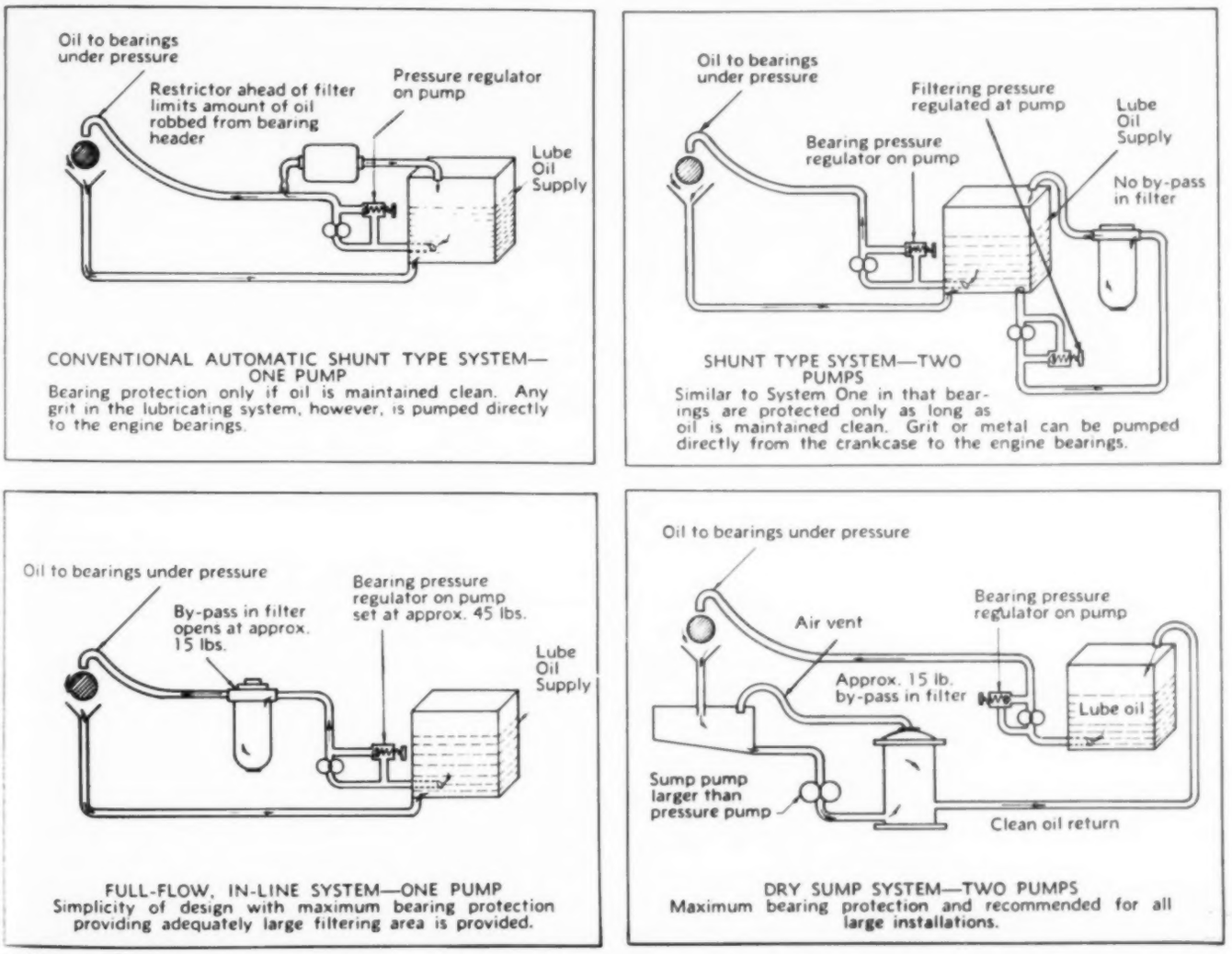
Oil to bearings under pressure
Restrictor ahead of filter limits amount of oil robbed from bearing header
Pressure regulator on pump
Lube Oil Supply
CONVENTIONAL AUTOMATIC SHUNT TYPE SYSTEM—ONE PUMP
Bearing protection only if oil is maintained clean. Any grit in the lubricating system, however, is pumped directly to the engine bearings.
Oil to bearings under pressure
Filtering pressure regulated at pump
Lube Oil Supply
Bearing pressure regulator on pump
No by-pass in filter
SHUNT TYPE SYSTEM—TWO PUMPS
Similar to System One in that bearings are protected only as long as oil is maintained clean. Grit or metal can be pumped directly from the crankcase to the engine bearings.
Oil to bearings under pressure
By-pass in filter opens at approx. 15 lbs.
Bearing pressure regulator on pump set at approx. 45 lbs.
Lube Oil Supply
FULL-FLOW, IN-LINE SYSTEM—ONE PUMP
Simplicity of design with maximum bearing protection providing adequately large filtering area is provided.
Oil to bearings under pressure
Air vent
Bearing pressure regulator on pump
Approx. 15 lb. by-pass in filter
Lube oil
Sump pump larger than pressure pump
Clean oil return
DRY SUMP SYSTEM—TWO PUMPS
Maximum bearing protection and recommended for all large installations.

FIGURE 3—Schematic of various conventional types of lubricating systems in general use on larger type engines like those used on pipe lines.

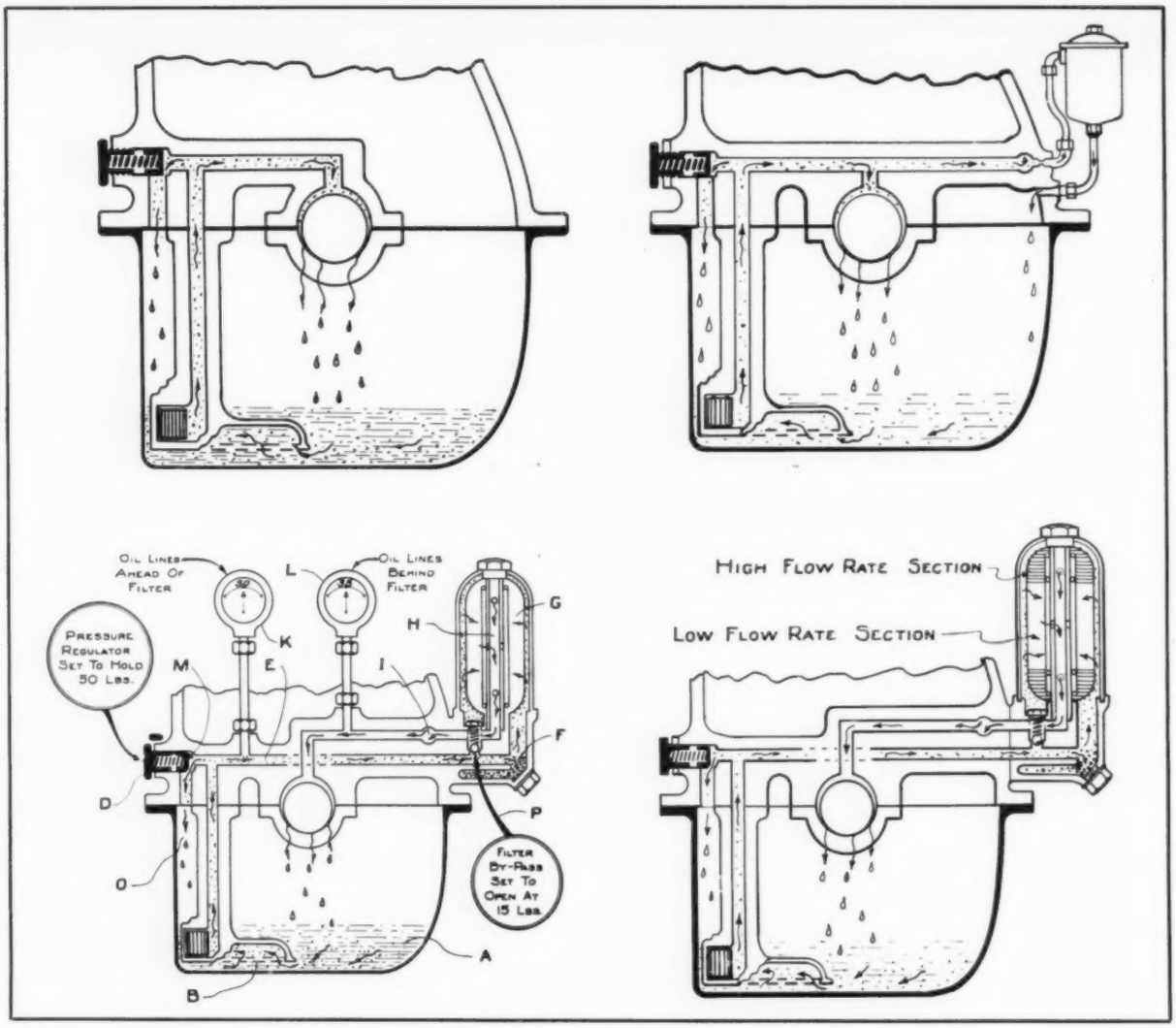

FIGURE 4—Conventional full pressure recirculating systems as applied to modern smaller engines when oil passages are drilled in crankcase.

Fuels. Next in importance to air for combustion is fuel for combustion. If fuels normally were clean, pure and free of all harmful contaminants which cause abrasion, corrosion or destruction of lubricated surfaces, there would be practically no need for filters on the fuel except as an insurance policy. However, when economical operation is a factor, economy in fuel costs becomes an important consideration. Therefore, another engineering compromise: How cheap and how low a grade of fuel can be used and how much does it cost to process this fuel to make it safe for continuous, economical use.

The most economical place for a pipe line pumping plant to obtain fuel is from the pipe line, eliminating transportation and refining costs as well as a large investment in storage tanks, etc. This is a conventional practice on pipe line installations.

Lube-Oil Filters. Regarding lubricating oil filters, the principal function is prevention of wear of lubricated surfaces and preservation of the lubricant. The principal cause of bearing wear is the inclusion of abrasives and corrosive materials circulating with lubricant. If a so-called shunt type filter is used, abrasives and corrosive materials can circulate until they eventually are trapped out of circulation by the relatively small amount of oil passing through the shunt type filter.

However, if (1) a modern full flow filter is properly built into the lubricating system and efficiency of the filter is such that all oil passes through the filter, even on cold starts, and if (2) the porosity of the filter is such that all harmful particle sizes of abrasives are removed at each pass and, (3) that harmful acids, etc., from products of combustion are removed or neutralized, then complete function of the filter is accomplished. Oil passing through the filter, especially compounded oils, should not be robbed of beneficial additives by the process of filtration, whether it be full flow or shunt type.

Typical Plant Layout. Figure 5 indicates a typical plant layout, schematically drawn to indicate a single unit of a large diesel pumping installation where oil is taken from the pipe line to a main storage tank (A) from where it is processed for use in the engine directly from the pipe line.

The fuel system shown can be a central purifying plant where fuel for all plant engines is processed continuously and maintained at an elevated temperature by re-circulation through a primary and secondary purifying system. Centrifuges are not required as heavy sludge and materials that can be affected by gravity are coagulated and coalesced before the fuel is brought into the filtering

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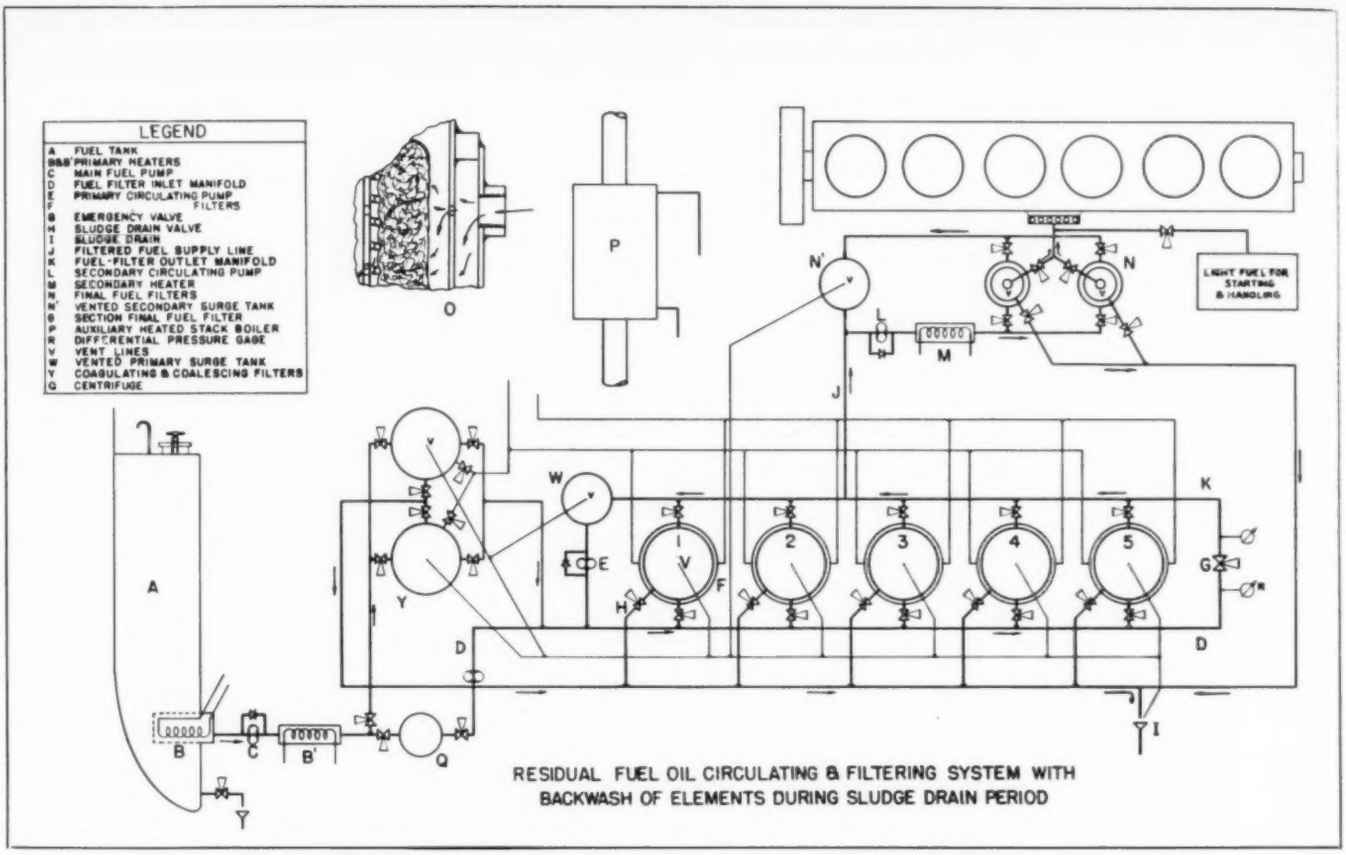
LEGEND
A FUEL TANK
B&B' PRIMARY HEATERS
C MAIN FUEL PUMP
D FUEL FILTER INLET MANIFOLD
E PRIMARY CIRCULATING PUMP
F FILTERS
G EMERGENCY VALVE
H SLUDGE DRAIN VALVE
I SLUDGE DRAIN
J FILTERED FUEL SUPPLY LINE
K FUEL-FILTER OUTLET MANIFOLD
L SECONDARY CIRCULATING PUMP
M SECONDARY HEATER
N FINAL FUEL FILTERS
N' VENTED SECONDARY SURGE TANK
O SECTION FINAL FUEL FILTER
P AUXILIARY HEATED STACK BOILER
R DIFFERENTIAL PRESSURE GAGE
V VENT LINES
W VENTED PRIMARY SURGE TANK
Y COAGULATING & COALESCING FILTERS
Q CENTRIFUGE
LIGHT FUEL FOR STARTING & HANDLING
RESIDUAL FUEL OIL CIRCULATING & FILTERING SYSTEM WITH BACKWASH OF ELEMENTS DURING SLUDGE DRAIN PERIOD

FIGURE 5—Typical plant layout schematically drawn to indicate a single unit of a large diesel pumping installation.

system. After the fuel has been brought into the continuously circulating filtering system, the temperatures are elevated above that at which water vaporizes. It is, therefore, vented off, under pressure, along with gases which may cause trouble with vapor locks in the system.

From long experience in processing heavy fuel for large diesel engines, many improvements, as is indicated in this system, were made. The function is to heat the fuel as soon as it leaves the fuel tank, (A) to approximately 200° F. by the heaters (B and B¹), then to maintain 25 pounds pressure of the fuel line by the by-pass type pump (C). The fuel is then fed into duplex coagulating and coalescing filters (Y) and then into manifold (D) which connects the inlet side of five filters (F), which are connected as shown, with the outlet into a discharge manifold (K). By-pass type circulating pump (E) insures that a constant 25 pound pressure is maintained on the filters and a uniform velocity causes the fuel to be circulated continually while the engine is in operation; thus, more than one pass is made through the filters. In fact, the fuel is continuously filtered during operation.

Another important feature is that all of the filters are jacketed and the temperature is maintained at approximately 300° F., insuring a low viscosity and uniform flow rate through the filters. The temperature also insures that any entrained water will be converted to steam which is disposed of easily through vents (V), in surge tanks (W and N¹), and also in the top of the filters.

From this it can be appreciated that, with certain types of heavy Bunker C type fuel, a centrifuge may have very little, if any, value in removing certain kinds and types of sludge. Furthermore, the possibility of homogenizing certain other materials in the fuel by the centrifuge is eliminated. The homogenizing of oil, water and certain forms of contaminants imposes a relatively heavy load on the filters, and such homogenizing by a centrifuge is in many cases, a detriment rather than a help in cleaning up heavy fuel oil.

Other means perhaps can be used to aid the filters in eliminating dirt from the fuel system, however, as shown at (Y), duplex coagulators and coalescers are provided which collect a very large part of all heavy material in the fuel. They also can be blown out with steam, thus saving a considerable amount of filter expense. A backwashing means of cleaning the filter elements also is provided which will get rid of considerable amounts of dirt, water, sludge, etc., before it is necessary to change the filter elements because they can no longer be backwashed to any advantage. This feature may eliminate the additional expense of a centrifuge on the line. However, if a centrifuge is justified and desired, it can be installed as indicated at (Q).

As in all filter installations, time between backwashing or replacing the filter elements will depend entirely upon the amount of dirt encountered in the fuel. If clean diesel fuel were used, filtering installation would not require the temperature shown and the elements would last indefinitely if the fuel contained no solids, gums, or other harmful matter. Conversely, if 1 percent of solids, water, etc., were encountered for every hundred tons of fuel used, one ton of sludge, solids, etc. would have to be destroyed. In other words, the amount of dirt in the fuel is a direct criterion of how often the filter elements will have to be changed. **The End.**

Pumping Progress Report

FOR PETROLEUM ENGINEERS

An advertisement prepared by the Aldrich Pump Co., Member of Hydraulic Institute, U.S.A.

PUMPING LIQUID BUTANE AND PROPANE is a typical operational headache successfully handled by the Aldrich Pump Company Engineers. It was a particularly tough pumping problem for one large pipe line company; they had to move butane 186 miles — from a Texas oil field to a Gulf Coast refinery.

PUMPING LIGHT-GRAVITY FLUID AT HIGH PRESSURES required the positive displacing action of conventional reciprocating pumps plus the flexibility of capacity provided by centrifugals. And Aldrich Engineers knew the answer — the Aldrich-Groff Controllable Capacity "POWR-SAVR" Pump.

STEPLESS STRAIGHT LINE CONTROL OF CAPACITY, from zero to rated maximum output, was possible with the "POWR-SAVR". Pump delivery was automatically controlled to suit varying requirements and power consumption became nearly proportional to the rate of output, affording desirable power savings.

SURGE TANKS WERE ELIMINATED, due to the "POWR-SAVR's" ability to meet immediate changing line conditions. This eliminated associated evaporation losses, co-mingling of different batches, and much of the danger of handling highly flammable material. Gone, too, was the need for bypassing to handle excess quantities of pump output.

UPRIGHT DESIGN of the "POWR-SAVR" places discharge valves directly over the plungers and inlet valves at one side. Efficient valve action permits the pump to operate at the high rate of 240 rpm. Another design feature was the use of porcelain plungers, reducing packing and leakage troubles.

THE ALDRICH PUMP COMPANY has been solving the difficult pumping problems of American industry since 1902. We've never turned down a challenge — many of yesterday's tough pumping problems are today routine.

DATA SHEET 65A, describing the Aldrich-Groff Controllable Capacity "POWR-SAVR" Pump will be sent to you on request. Or our representative will be glad to call. Address your request to: The Aldrich Pump Company, 6 Pine Street, Allentown, Pa. (Advertisement)

Aldrich-Groff Controllable Capacity "POWR-SAVR" Pump suitable for pumping butane and other light-gravity fluids.

...for your tough pumping problems specify ALDRICH

This machine is ideal for pumping light-gravity fluids at medium and high pressures. It combines features of superior efficiency and positive displacing action of reciprocating pumps with the flexibility of capacity of centrifugal pumps. A unique, reliable mechanism controls the plunger-stroke from zero to rated output without change of speed of power source, providing desired savings in power plus top efficiency.

Typical Applications for the Aldrich-Groff "POWR-SAVR" Pump:

Pipe Line Service	Process Charging
Boiler Feeding	Oil-burner Supply

Write for Data Sheet 65A, describing the features of the "POWR-SAVR" Pump. Or, if you prefer, our representative will be glad to call.

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Originators of the Direct Flow Pump

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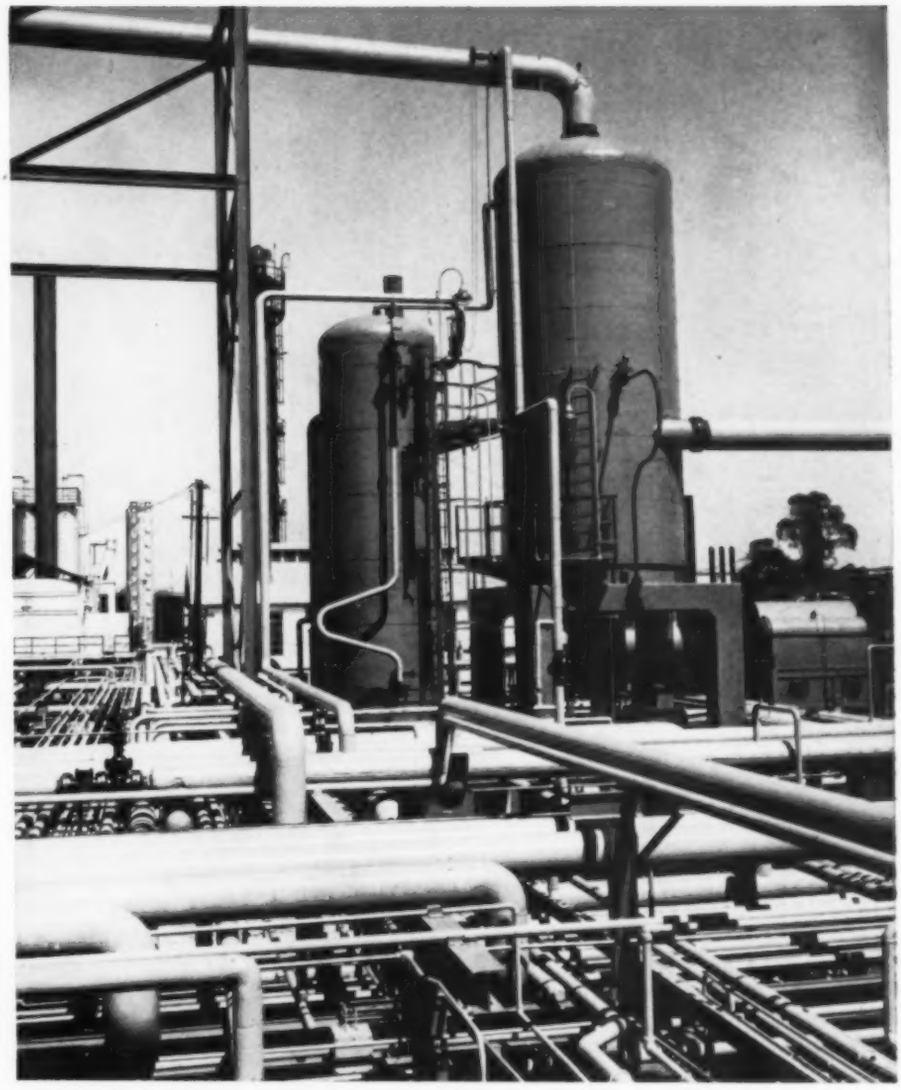


Crude distillation section — Complex piping means complex design.

Here's how to save time in computing stresses in a three-dimensional piping system:

How to Calculate Pipe Stresses

Part 1. How to Use the Tabular Method

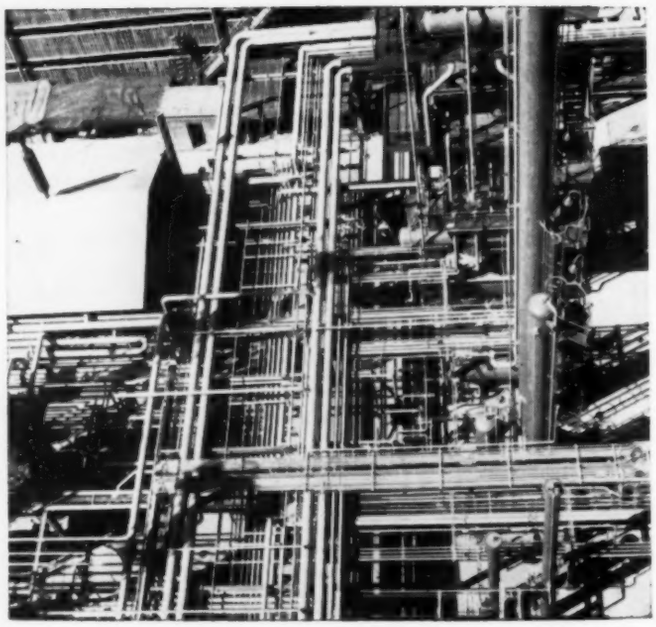
Part 2. Systems with Different Moments of Inertia

Part 3. How to Handle Elbows and Bends

By K. HAO HSIAO,
The Ralph M. Parsons Company, Los Angeles

THIS NEW TABULATION method can save you hours of time in calculating the stresses in three-dimensional piping systems yet accuracy is not affected. The more complicated the piping system, the greater the proportion of simplification.

When the piping system contains branches with different moments of inertia, ratios of the cross-sectional moments of inertia are applied to the equations for piping with constant moment of inertia, i.e., Eqs. (5), (6), and (7), by multiplying I's and I_o's in Eqs. (10) by these ratios. For instance, if the piping system contains only branches ab and bc with moment of inertia I_1 and the remaining branches with I_2, then from Eqs. (10)



Catalytic polymerization unit—Good design for integrated piping.

we have for X-Y plane,

$$(I'_x)_{ab,\,bc} = \sum_{i=ab,\,bc}\left(\frac{I_2}{I_1}l\right)_i y_i^2 + 0.3\sum_{i=\text{Branches}\,\|\,\text{Z-axis}}\left(\frac{I_2}{I_1}l\right)_i y_i^2 - \bar{y}^2\left[\sum_{i=ab,\,bc}\left(\frac{I_2}{I_1}l\right)_i + 0.3\sum_{i=\text{Branches}\,\|\,\text{Z-axis}}\left(\frac{I_2}{I_1}l\right)_i\right]$$

$$(I'_x)_{cd,\,de\ldots} = \sum_{i=cd,\,de\ldots.} l_i y_i^2 + 0.3\sum_{i=\text{Branches}\,\|\,\text{Z-axis}} l_i y_i^2 - \bar{y}^2\left[\sum_{i=cd,\,de\ldots.} l_i + 0.3\sum_{i=\text{Branches}\,\|\,\text{Z-axis}} l_i\right]$$

and, for X-Z plane,

$$(I''_x)_{ab,\,bc} = \sum_{i=ab,\,bc}\left(\frac{I_2}{I_1}l\right)_i z_i^2 + 0.3\sum_{i=\text{Branches}\,\|\,\text{Y-axis}}\left(\frac{I_2}{I_1}l\right)_i z_i^2 - \bar{z}^2\left[\sum_{i=ab,\,bc}\left(\frac{I_2}{I_1}l\right)_i + 0.3\sum_{i=\text{Branches}\,\|\,\text{Y-axis}}\left(\frac{I_2}{I_1}l\right)_i\right]$$

$$(I''_x)_{cd,\,de\ldots} = \sum_{i=cd,\,de\ldots.} l_i z_i^2 + 0.3\sum_{i=\text{Branches}\,\|\,\text{Y-axis}} l_i z_i^2 - \bar{z}^2\left[\sum_{i=cd,\,de\ldots.} l_i + 0.3\sum_{i=\text{Branches}\,\|\,\text{Y-axis}} l_i\right]$$

The centroidal moments of inertia I_{ox} are

$$(I_{ox})_{ab,\,bc} = \frac{I_2}{12I_1}\sum_{i=ab,\,bc}(l_y^3 + l_z^3)_i$$

$$(I_{ox})_{cd,\,de\ldots} = \frac{1}{12}\sum_{i=cd,\,de\ldots.}(l_y^3 + l_z^3)_i$$

Combining the above terms, we have, for the piping system,

$$I_x = (I'_x)_{ab,\,bc} + (I'_x)_{cd,\,de\ldots} + (I''_x)_{ab,\,bc} + (I''_x)_{cd,\,de\ldots} + (I_{ox})_{ab,\,bc} + (I_{ox})_{cd,\,de\ldots} \quad (15)$$

From Eqs. (10), the products of inertia in X-Y plane are

$$(I_{xy})_{ab,\,bc} = \sum_{i=ab,\,bc}\left(\frac{I_2}{I_1}l\right)_i y_i^2 + 0.3\sum_{i=\text{Branches}\,\|\,\text{Z-axis}}\left(\frac{I_2}{I_1}l\right)_i x_i y_i - \bar{x}\bar{y}\left[\sum_{i=ab,\,bc}\left(\frac{I_2}{I_1}l\right)_i + 0.3\sum_{i=\text{Branches}\,\|\,\text{Z-axis}}\left(\frac{I_2}{I_1}l\right)_i\right]$$

and

$$(I_{xy})_{cd,\,de\ldots} = \sum_{i=cd,\,de\ldots.} l_i x_i y_i + 0.3\sum_{i=\text{Branches}\,\|\,\text{Z-axis}} l_i x_i y_i - \bar{x}\bar{y}\left[\sum_{i=cd,\,de\ldots.} l_i + 0.3\sum_{i=\text{Branches}\,\|\,\text{Z-axis}} l_i\right]$$

Combining the above terms, we have, for the piping system,

$$I_{xy} = (I_{xy})_{ab,\,bc} + (I_{xy})_{cd,\,de\ldots} \quad (16)$$

Equations for I_y and I_z are similar to Eq. (15), and equations for I_{xz} and I_{yz} are similar to Eq. (16). Substituting these line inertia values on the left-hand side of Eqs. (5), (6) and (7), and substituting I_2 for I on the right-hand side of the same equations, we obtain three equations for solution of X, Y and Z forces, which are identical in form to the equations for a piping system with constant moment of inertia. Therefore, by multiplying l's and I_o's of branches ab and bc with the ratio I_2/I_1, we can use the same tables, i.e., Tables 1, 2 and 3 (see Part 1, February, 1956, PIPE LINE INDUSTRY) to obtain bending moments and torques.

The use of the above I_2/I_1 ratio is most efficient when the number of piping branches with I_2 far exceeds that of I_1. In general, when the piping system contains branches with different cross-sectional moments of inertia I_1, I_2, I_3, . . . I_n, of which the number of sections with I_n is predominant, then we apply ratios I_n/I_1, I_n/I_2, . . . I_n/I_{n-1} to the l's and I_o's of branches with cross-sectional moments of inertia other than I_n, and substitute I_n for I in Table 1.

Example 2

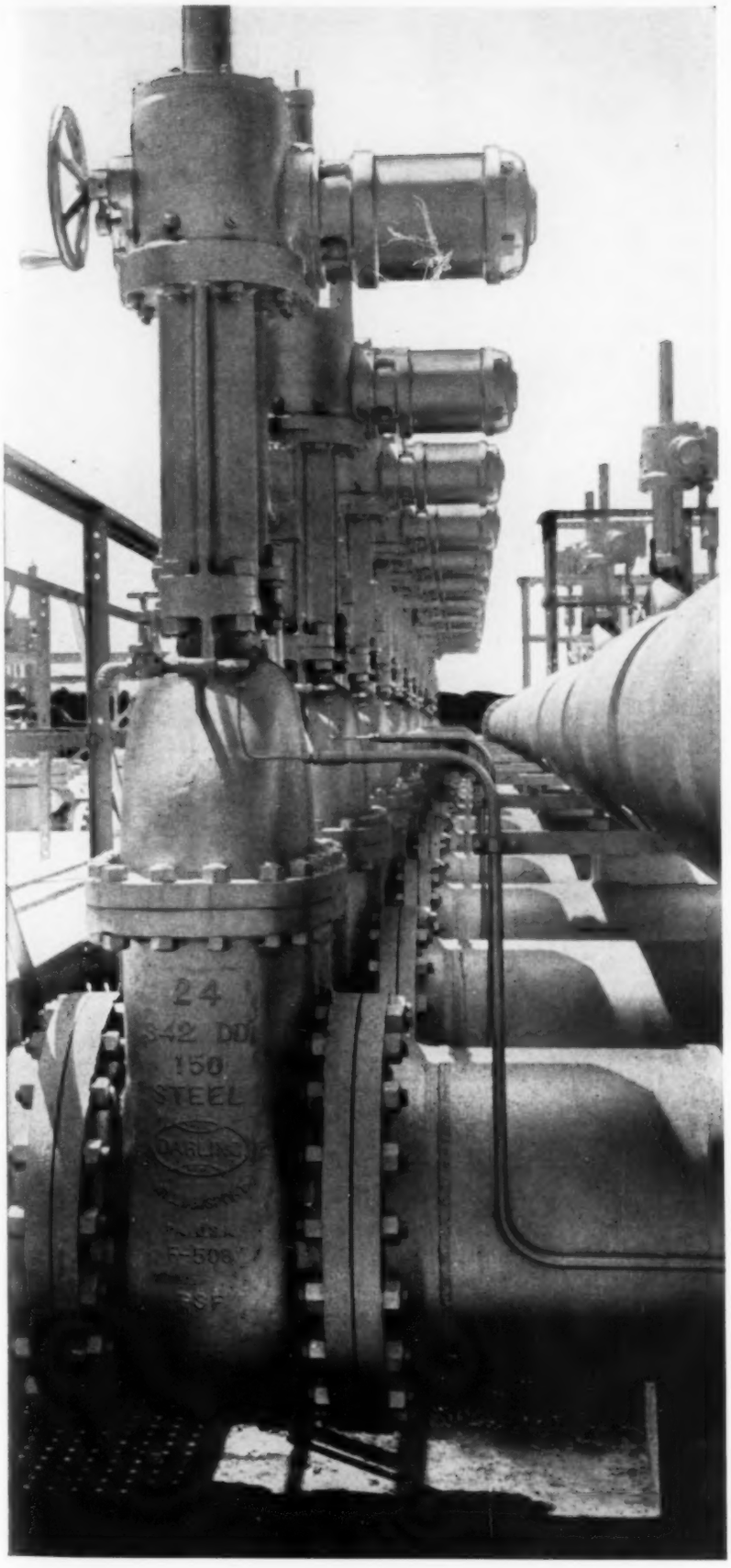
The tabular solution for a piping system with different cross-sectional moments of inertia can be illustrated by using the system in Example 1 and changing branch ab from 10 inch diameter to 8 inch diameter, schedule 40 ($I = 72.5$ in^4).

Since, in this case, the number of 10-inch pipe branches is predominant ($I = 160.8$ in^4), we apply the ratio $\frac{160.8}{72.5} = 2.22$ to the length and centroidal moment of inertia of branch ab as below.

$$l_{ab} = 2.22 \times 15 = 33.3 \text{ ft.}$$
$$(I_o)_{ab} = 2.22 \times \frac{15^3}{12} = 624 \text{ ft.}^3$$

Replacing values for branch ab in Table 1 of Example 1 with the above values and using $I = 160.8$ in^4, we obtain the tabular solution for this piping system with different moments of inertia.

Part 3 will appear in a coming issue.



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THESE Darling gate valves have one thing in particular no other gate valves can match—Darling's *fully revolving double disc, parallel seat principle.*

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◀ *Line-up of Darling 24" motor-operated steel gate valves at a major crude oil pumping station. Here, as elsewhere, Darling's fully revolving double disc feature pays off.*

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For more data on advertised products, use Readers' Service Cards, last page.

NEW "KING-SIZE" CARTRIDGES SAVE TIME AND LABOR

Now, Hercules produces "King-Size" cartridges in lengths of 24, 20, 16 and 12 inches, and in diameters of 1¼, 1½, 1¾, and 2 inches.

Available in all types of Hercules® dynamite, these long-length, small-diameter cartridges are now in full production.

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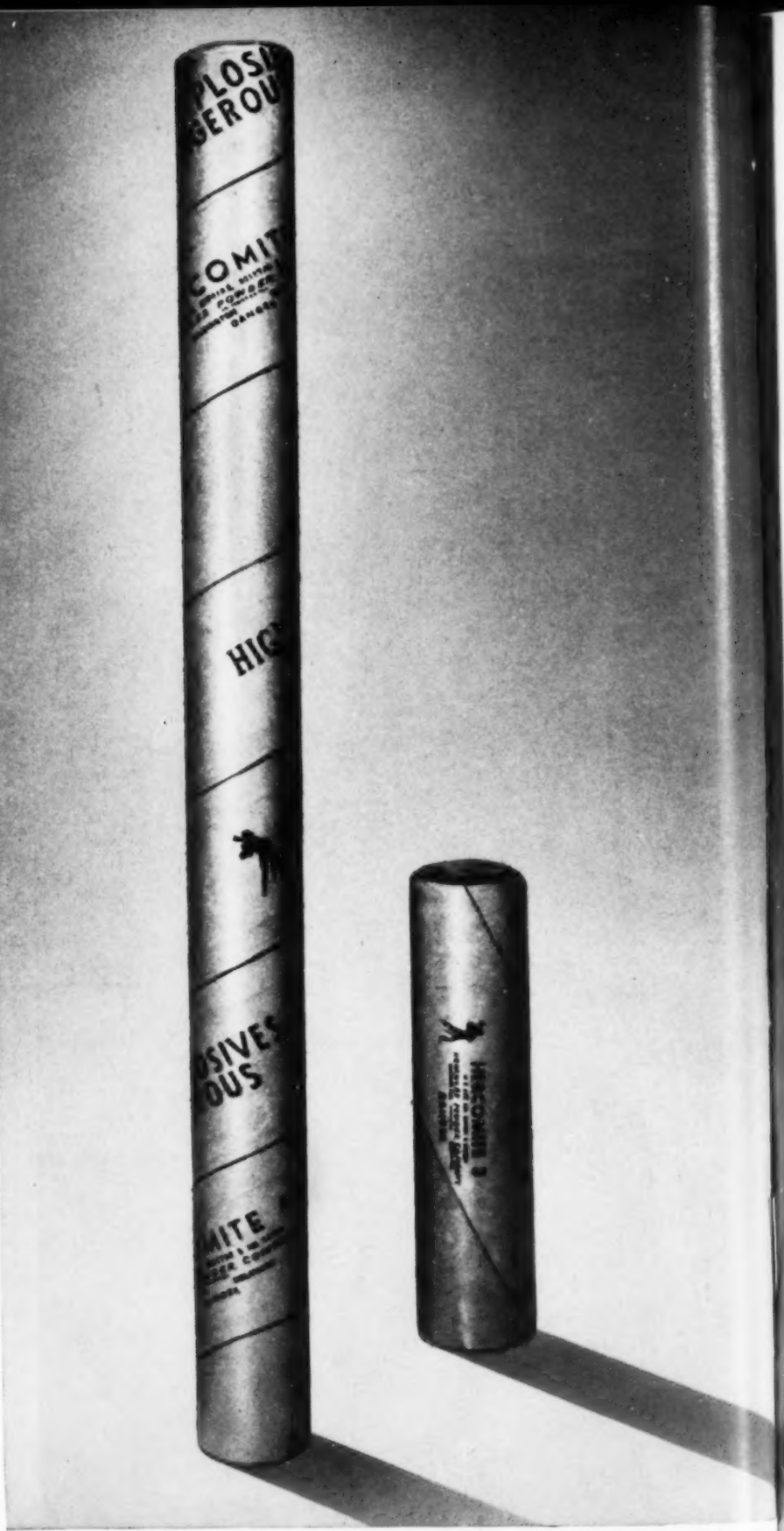
Our technical service and sales representatives will be glad to discuss with you how these "King-Size" cartridges can go to work for you.



THREE TIMES AS LONG ... Here is one of the new "King-Size" Hercules cartridges — 24 inches in length, shown alongside the same grade in the conventional 8 inch size.

HERCULES

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Birmingham, Ala.; Chicago, Ill.; Duluth, Minn.; Hazleton, Pa.; Joplin, Mo.; Los Angeles, Cal.; New York, N.Y.; Pittsburgh, Pa.; Salt Lake City, Utah; San Francisco, Cal.

A feed mill company representative points to a special conveyor belt installation on side of tank which will transfer wheat from trucks to storage tank. In the background are tanks that once were part of the Carter Oil Company's Cushing, Oklahoma, tank farm.

Surplus Storage Tanks Being Put to New Use

• Oil tanks once used for crude storage in Oklahoma converted into bins for storing wheat.

• Conversion may point way for similar use of other idle tanks that cannot be economically moved to new sites for storing oil.

GIANT 55,000-BARREL capacity crude oil tanks built to conserve a surplus flood of oil in the old Cushing-Drumright field near Yale, Okla., are now being used to store wheat.

This conversion may point the way to a new method for utilizing thousands of barrels of storage capacity in areas where the tanks are no longer needed and where dismantling and hauling to other locations may prove uneconomical.

This application of old lease tanks also is proving most advantageous to the agricultural industry which, with its increasing surpluses, is finding storage a difficult and expensive problem.

Converting crude oil tanks so that they can be "measured in bushels instead of barrels" is an idea developed by The Carter Oil Company.

One Carter veteran who has been with the company nearly 40 years and who visited the scene recalled that the 17 crude oil storage tanks sold to the Dannen Grain and Milling Company of St. Joseph, Mo., once were part of what was probably the largest tank farm in the world. He had handled payrolls for the tank farm from 1918 to 1929.

The tank farm was established some 40 years ago when little thought was given to the oil needs of the future. With prolific oil wells spouting in all directions there was a mad scramble to get the oil out of the ground, sell it and store what was left over. Sometimes, there wasn't enough tankage, and oil deteriorated in open pit storage ponds.

Things have changed since 1915. The Cushing field, which has produced almost 400 million barrels of oil since its discovery in 1912, still produces more than 6000 barrels a day from 1800 wells. However, pumping wells now dot the areas where hundreds of huge storage tanks once held millions of barrels of crude oil.

Purchase of the tank farm property early in 1915 was one of Carter's first ventures in the Mid-Continent area. That same year Western division headquarters were established in Tulsa and J. Edgar Pew was named agent.

Since 1918 Carter has been reducing its tank farm holdings in the Cushing field. It was along about then that the industry learned it was much cheaper, and resulted in the conservation of thousands of barrels of oil, if the oil was kept in the reservoir until it was needed.

In the process of converting the tanks from oil to wheat storage, Carter cleaned, processed the tank bottom residues and recovered some 40,000 barrels of oil and wax products. Then the inside and outside of the tanks were sand blasted and thoroughly cleaned with chemicals to a new brightness. The tanks were then equipped with a special aeration system which keeps the stored grain dry, and they were ready to receive the wheat.

The tanks are being used to store U. S. government-owned wheat that farmers couldn't sell last year. The wheat is being shipped in by railroad from terminal elevators, country elevators and farm storage facilities throughout the Middle West. The converted crude oil storage tanks each have an approximate wheat storage capacity of 4¼ million bushels which can be safely stored for years.

—The End

Rules of Thumb

FOR THE PIPELINER'S NOTEBOOK

$15 Per Rule of Thumb

These formulae from the pages of engineers' own notebooks yield rough, but reasonably accurate answers for design, maintenance and supply questions. The Editors will pay $15 for your pet Rule of Thumb. Send your Rule of Thumb to PIPE LINE INDUSTRY, P. O. Box 2608, Houston 1.

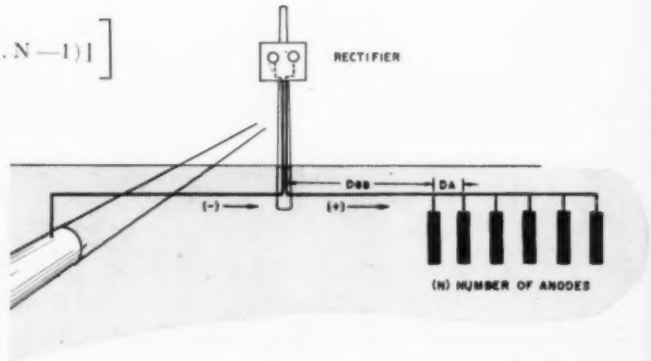
Corrosion Protection

—14—How to calculate the voltage drop in ground bed cable quickly.

Use the following formula for calculating the voltage drop in a copper ground bed cable:

$$V_T = \frac{R_{1000}}{1000}\left[I_T D_{GB} + D_A \left[(N-1)(I_T) - I_A (1+2+3+4 \ldots . N-1) \right] \right]$$

where V_T = Total voltage drop in volts
R_{1000} = Cable resistance per 1000 feet
I_T = Total current in amperes
$I_A = \frac{I_T}{N}$ Current per anode
D_{GB} = Distance from rectifier to first anode in feet
D_A = Distance between anodes in feet
N = Number of anodes in ground bed.



Example: What is the voltage drop in a copper wire ground bed cable in a cathodic protection system having a rectifier output of 225 amperes? The distance from rectifier to ground bed is 100 feet and 16 anodes are spaced on 20 feet centers. The cable used is No. 4 copper having a resistance of 0.2487 ohms per 1000 feet.

Then $R_{1000} = 0.2487$ ohms
$I_T = 225$ amperes
$I_A = \frac{225}{16} = 14$ amperes
$D_{GB} = 100$ feet
$D_A = 20$ feet
$N = 16$

$$V_T = \frac{.2487}{1000}\left[(225)(100) + 20\left[(15)(225) - (14)(120) \right] \right]$$
$$V_T = \frac{.2487}{1000}\left(22{,}500 + 20\,[1695] \right)$$
$$V_T = \left(\frac{.2487}{1000} \right)(56{,}400)$$
$$V_T = (.2487)(56.4)$$
$$V_T = 14.00 \text{ volts drop}$$

Correction

The Rule of Thumb for Pipe Line Construction—15—How to calculate the contraction or expansion of a pipe line resulting from temperature changes and estimate the allowances for slack in loops contained an error in the example solution.

The answer is 8 inches instead of 8 feet. Contraction for 1000 feet of pipe having a 100° F. temperature decrease would be:

$$\text{Contraction} = 0.8 \text{ inch} \times \frac{1000}{100} \times \frac{100}{100}$$
$$= 0.8 \times 10 \times 1$$
$$= 8 \text{ inches.}$$

Please correct this in your notebook.

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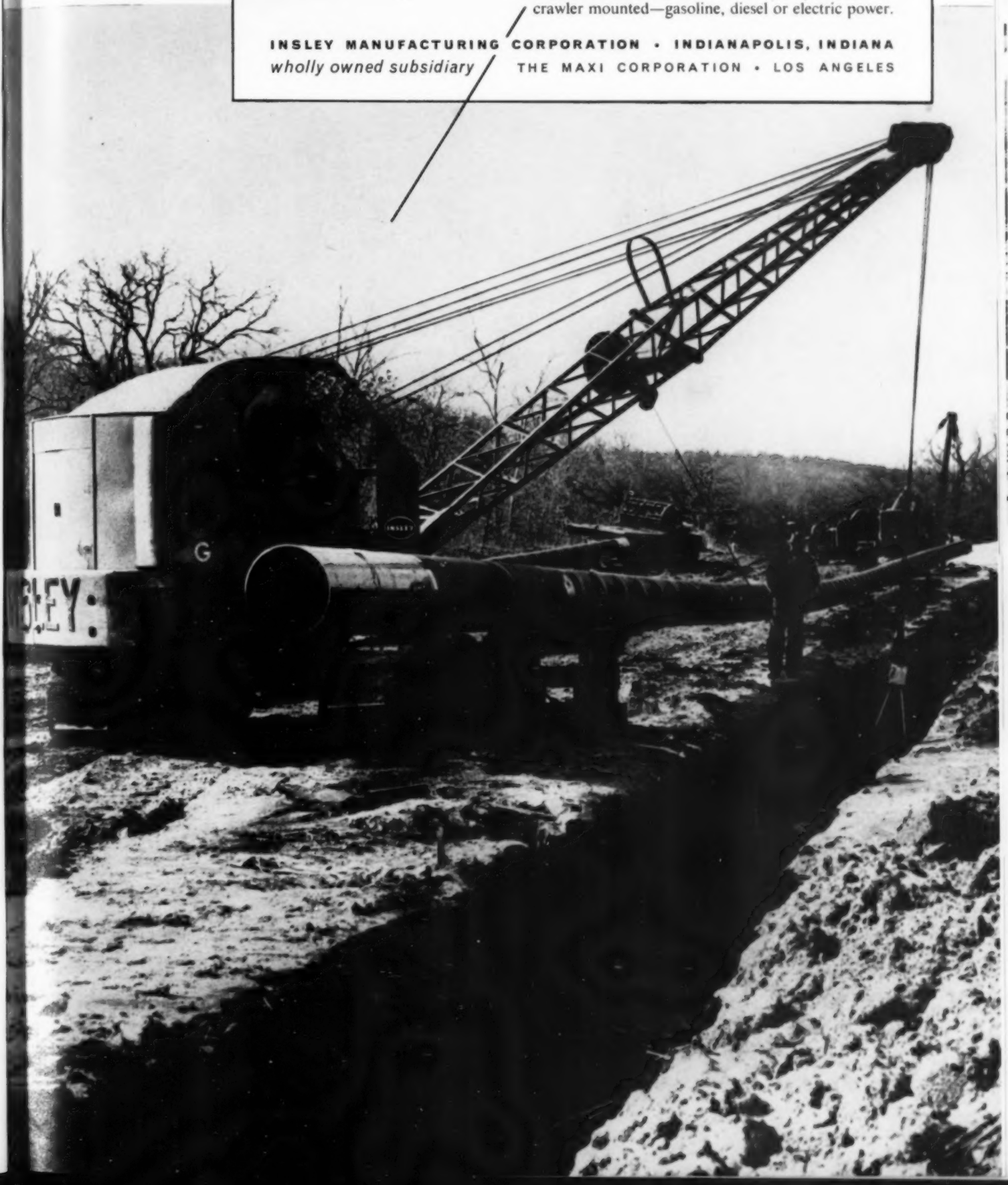
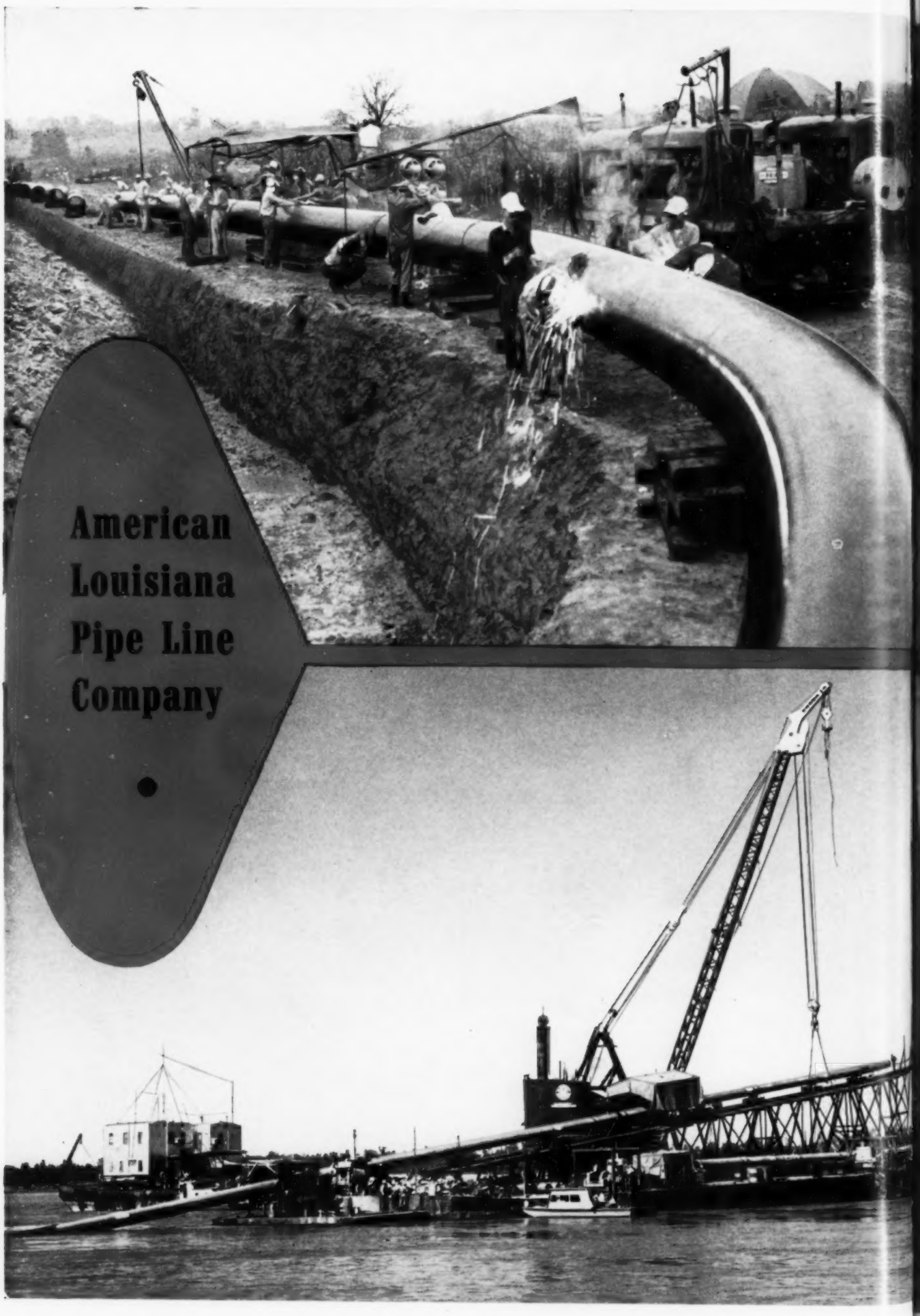
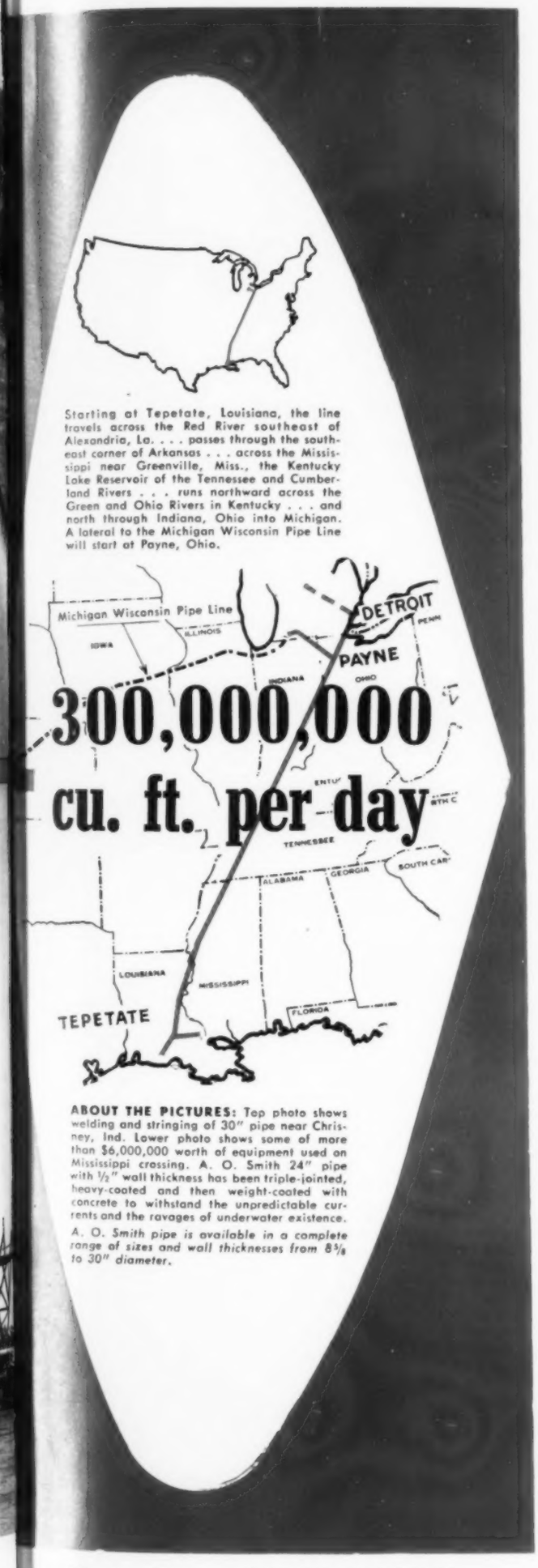



American
Louisiana
Pipe Line
Company


Starting at Tepetate, Louisiana, the line travels across the Red River southeast of Alexandria, La. . . . passes through the southeast corner of Arkansas . . . across the Mississippi near Greenville, Miss., the Kentucky Lake Reservoir of the Tennessee and Cumberland Rivers . . . runs northward across the Green and Ohio Rivers in Kentucky . . . and north through Indiana, Ohio into Michigan. A lateral to the Michigan Wisconsin Pipe Line will start at Payne, Ohio.
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IOWA
INDIANA
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GEORGIA
LOUISIANA
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ABOUT THE PICTURES: Top photo shows welding and stringing of 30" pipe near Chrisney, Ind. Lower photo shows some of more than $6,000,000 worth of equipment used on Mississippi crossing. A. O. Smith 24" pipe with ½" wall thickness has been triple-jointed, heavy-coated and then weight-coated with concrete to withstand the unpredictable currents and the ravages of underwater existence.
A. O. Smith pipe is available in a complete range of sizes and wall thicknesses from 8⅝ to 30" diameter.

793 Miles of A. O. Smith Line Pipe

THE new American Louisiana Pipe Line is being built to meet the tremendous requirements for additional supplies of natural gas in Michigan, Wisconsin and parts of Iowa and Missouri. When complete it will bring 300,000,000 cu ft of gas per day to these states. This capacity can be increased to 550,000,000 feet per day by the addition of compressor horsepower.

The main line will be 30" in diameter and extend 1000 miles from southern Louisiana to a connection with Michigan Consolidated Gas Company at Willow Run. It will cross 8 states and nine major rivers and lakes, marshes, swamps, rice fields, forests and the mountains of Tennessee, Kentucky and southern Indiana. Also, approximately 78 miles of 24" and 26" main line will be laid in southern Louisiana.

The pipe line system was designed by Ford, Bacon & Davis, Inc., and construction is being done by H. C. Price Company, Houston Construction Company and Brown & Root, Inc.

A. O. Smith Corporation played an important part in this new line by furnishing 758 miles, over 75%, of the 30" pipe from its Houston Mill, A. O. Smith Co. of Texas, and 35 miles of the 26" pipe, together with the 24" heavy wall pipe used for the major river crossings, from its Milwaukee Mill.

For almost 30 years A. O. Smith has held a high-standard of quality control and this quality control has been maintained at every step of the manufacturing process. That's why A. O. Smith pipe made and installed in 1928 is still in operation. That's why so much A. O. Smith pipe has been used in nearly every important high pressure line.

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Natural Gas Pipeline Plans $80 Million Expansion

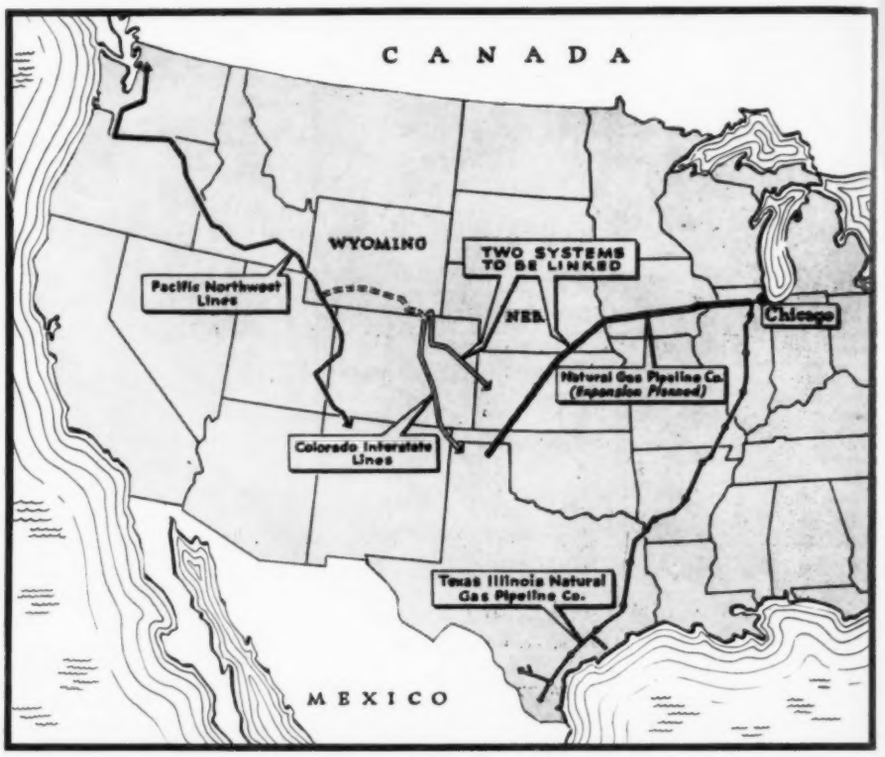
Natural Gas Pipeline Company of America has applied to the FPC for approval of an $80 million expansion plan to tie its midwestern market into Rocky Mountain sources of natural gas.

The project will add 435 Mmcf a day to the system's pipe line delivery capacity, a 40 percent increase over present capacity.

Most of the gas will be purchased from Colorado Interstate Gas Company, which plans to build a connecting pipe line to join Natural Gas Pipeline's present transmission line.

The western end of this link would connect Colorado Interstate's new Wyoming supply line from Pacific Northwest Pipe Line Corporation with Natural Gas Pipeilne's main line in eastern Nebraska.

Colorado Interstate will in turn buy up to 100 Mmcf from Pacific



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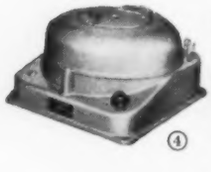

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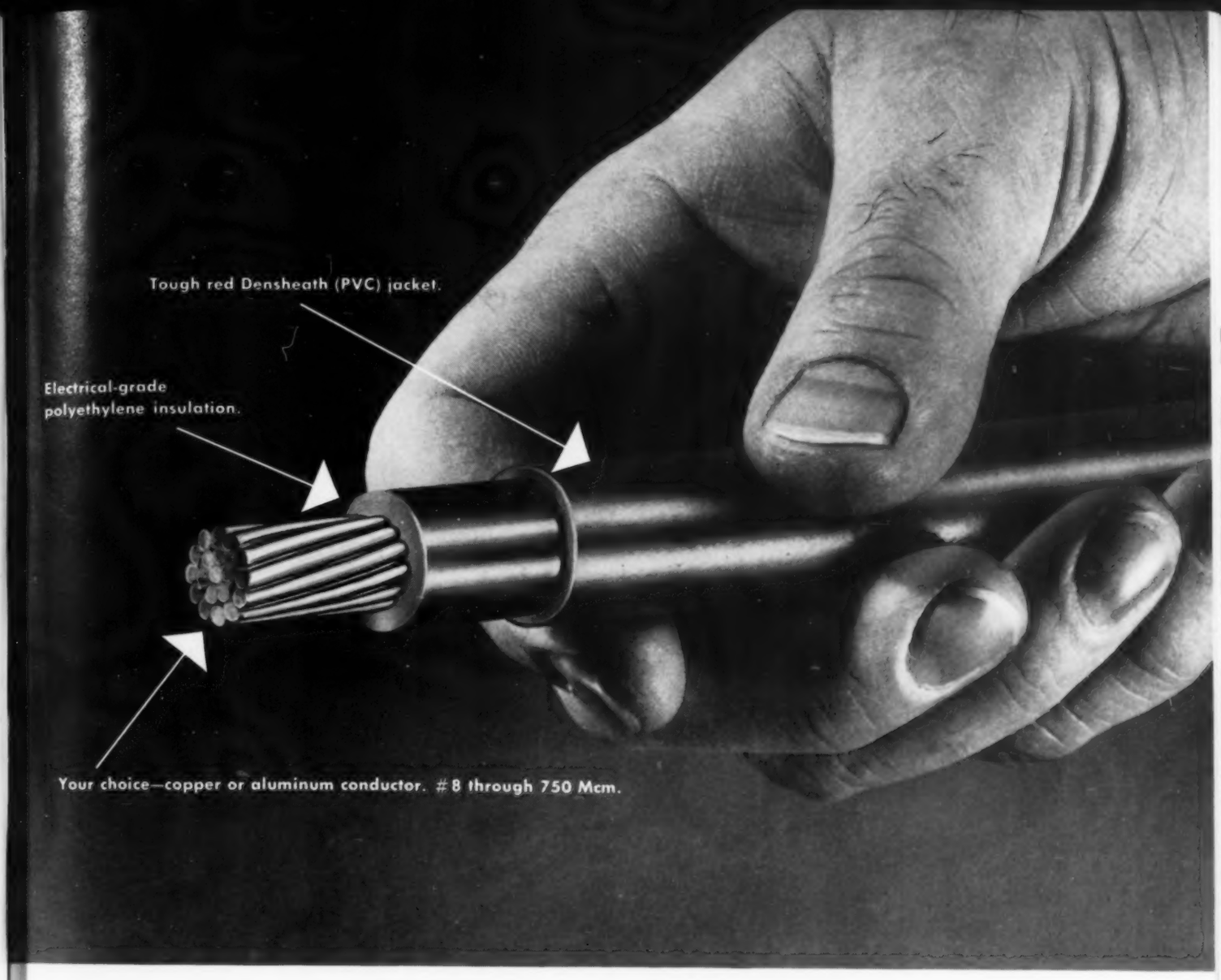
Tough red Densheath (PVC) jacket.
Electrical-grade polyethylene insulation.
Your choice—copper or aluminum conductor. #8 through 750 Mcm.

Here's why Anaconda's new Type CP Cable lasts far longer in Cathodic Protection

Cathodic Protection demands a special cable of its own. Anaconda's *Type CP Cable* offers top resistance to oil, soil acids, and electro-endosmosis . . . means *longer cable life*.

A pencil pokes through this corroded metal! Why chance trouble like this? Cathodic Protection and Anaconda Type CP Cable effectively check corrosion of buried metals.

Ordinary rubber cables – good as they are for the jobs for which they were *intended*–just can't give best service under the special conditions of cathodic protection.

Unless cables are *designed* to combat endosmosis‡–plus moisture, oil and soil acids–they just won't do.

But now Anaconda offers a special Type CP Cable–that *lasts far longer* than ordinary cable in cathodic-protection systems.

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To order, or for more information–call the Man from Anaconda. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York. 55342

*Reg. U. S. Pat. Off.

‡*Insulation failure when subject to d-c potential in wet locations.*

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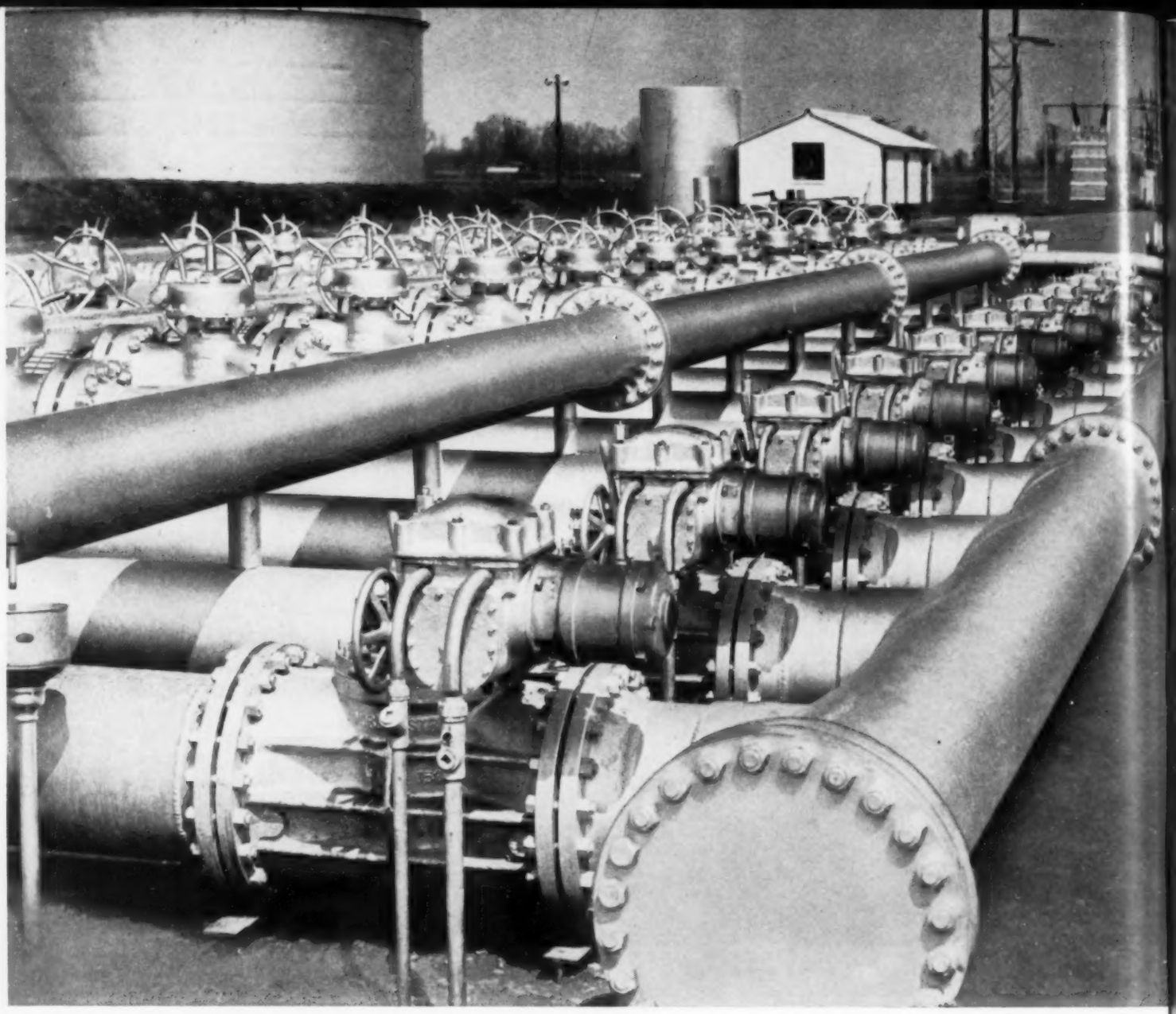

ROCKWELL-Nordstrom VALVES

close faster, easier and stay tight!

Naturally the faster and easier a valve closes, the simpler and less costly its power mechanism can be. In Rockwell-Nordstrom valves the actuator only has to move the tapered lubricated plug through a quarter-turn for full opening or closure. The Sealdport* lubricant system serves as millions of tiny bearings to greatly reduce torque. And it serves the extra purpose of sealing the seating surfaces bottle-tight. Compare this to the many turns required to close ordinary valves and the excessive torque necessary to wedge-in the seats. It's easy to see why Rockwell-Nordstrom valves have proven to be the most reliable valves for automatic pipe line control.

Rockwell-Nordstrom valves are available in a complete range of sizes from ½" to 30" and in pressure ratings from 175 to 1440 lbs. for electric, cylinder and pneumatic operation. Write today for Bulletin V-214, "Power Operated Rockwell-Nordstrom Valves." Rockwell Manufacturing Company, Pittsburgh 8, Pa. *Canadian Valve Licensee:* Peacock Brothers Limited.

**Registered trade mark Rockwell Manufacturing Company*

ROCKWELL-Nordstrom VALVES

Lubricant Sealed for Positive Shut-off

40th YEAR *of lubricated plug valve leadership*

Northwest Pipeline Corporation. FPC approval has been received for a connection between Colorado Interstate and Pacific Northwest's lines. Pacific Northwest taps new supply fields in the Rockies.

The 85 Mmcf of additional supply required to bring the total increase from 350 to 435 million will come from other present sources on Natural Gas Pipeline.

Natural's proposed construction program will add what is virtually a third transmission line paralleling the present dual lines of Natural and interconnecting with it. The proposed expansion includes a 389-mile 36-inch line in the first 476 miles west of the Joliet terminal, parallel looping most of the route of the two existing transmission mains; and 91 miles of 30-inch loops over various segments of the remaining 415 miles of the line.

The program also includes stepping up the system's total compressor station power from 151,500 to 194,500 horsepower by modifying and revamping 86 gas engine-driven compressor units at nine of the company's 12 compressor stations, and installation of two new 3000-hp centrifugal gas turbine compressor units at the contemplated junction with the new connecting line.

Recently Natural Gas Pipeline received FPC approval on another project authorizing the construction of a 350-mile pipe line to transport into its system natural gas purchased in Jack, Wise and Parker counties, Texas, to its existing West Texas lines. The line will extend from Wise County to Fritch, Texas. Certificates were granted to Mid-Continent Petroleum Corporation, Warren Petroleum Corporation, and Oil Drilling Inc. to sell and deliver to Natural 78 Mmcf of gas daily.

Total cost of this project is $28.5 million. In addition, Natural proposes to build gathering facilities in Jack and Wise counties and make changes in existing production and gathering facilities in the Panhandle field. Production and gathering facilities are estimated to cost $3.5 million.

Transco Seeks Approval For Louisiana Project

Transcontinental Gas Pipe Line Corporation of Houston has applied to the FPC for authorization to con-

Super bending quality and workability speeds construction . . .

Lone Star API Line Pipe

There's real economy and extra speed in construction when you use Lone Star pipe. Lone Star's convenient pipe inventories, the direct haul of the pipe from the mill, the stringing of the pipe along the right-of-way without rehandling, superior bending quality . . all these facts contribute to the sweeping trend to Lone Star.

Lone Star's vast, completely integrated steel plant was especially built for and dedicated to serving the dynamic oil and gas industries. Lone Star meets API specifications.

Neighbor, wherever you are, specify Lone Star . . and we both get a good deal!

Lone Star STEEL COMPANY

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struct pipe line facilities to take an additional 38 Mmcf of natural gas per day from the Live Oak gas field in Vermilion Parish, La.

Estimated to cost $707,000, the proposed facilities will include 12 miles of pipe line and two meter stations. Transcontinental plans to purchase the additional gas from Sinclair Oil and Gas Company. The additional gas will bring Transcontinental's total take from the Live Oak field up to 45 million cubic feet daily.

Contracts Let on Pacific Northwest Line

Contracts for 1956 construction on the Pacific Northwest Pipeline Corporation's natural gas transmission system have been awarded.

Fish Northwest Constructors, Inc., builders of the 1487-mile gas line from the San Juan Basin fields of New Mexico to the Pacific Northwest, have announced the awarding of contracts covering 420 miles o main line and 340 miles of lateral in the state of Washington. Severa contractors are already in the fiel and 15 will be working on schedule in Washington in the spring.

Main line contracts call for 26-incl pipe with laterals of from 4 to 20-inch pipe. Work on the main lin covered by these contracts begin near Plymouth, Wash., to Sumas nea the Canadian border. Laterals include lines to Walla Walla, Spokane, Wenatchee and the Columbia River crossing and lateral to Portland. Contracts also were awarded for 129 miles of laterals for Idaho markets in Coeur D'Alene, Moscow and Lewiston.

Contractors on the main line schedules are as follows:

Schedule 13—81 miles of 26-inch between Plymouth and a point two miles west of Goldendale, A. P. V. Company, Inc., Fort Worth, Texas.

Schedules 14 and 15—56 miles of 26-inch between Goldendale and a point near Stevenson, Engineers Limited, Inc., San Francisco.

Schedules 16 and 17—79 miles of 26-inch between Stevenson and Toledo, Midwestern Constructors, Inc.

Schedule 18—64 miles of 26-inch between Toledo and a point two miles southeast of Tacoma, River Construction Corporation.

Schedule 19—53 miles of 26-inch between a point two miles southeast of Tacoma and the vicinity of Duvall, B. & M. Construction Company.

Schedules 20 and 21—87 miles of 26-inch between Duvall and the Canadian border near Sumas, Curtis Construction Company.

Construction contracts for the lateral lines have been awarded to the following:

Walla Walla Lateral—31 miles of 6-inch from main line to Walla Walla, Hood Construction Company.

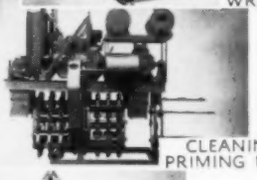
Spokane Lateral—156 miles of 20-inch and 16 inch to Spokane; 129 miles of laterals for Idaho markets, including 6-inch between Spokane and Coeur D'Alene; 4 to 12-inch between point near Ritzville on Spokane lateral to Moscow and Lewiston, Idaho. R. H. Fulton & Co.

Yakima-Wenatchee Lateral—137

NO MORE HAMMERING

COATING AND WRAPPING MACHINES

PERRAULT PNEUMATIC INSIDE LINE-UP CLAMP



CLEANING AND PRIMING MACHINES

PNEUMATIC-TIRED LOWERING-IN CRADLE

The first line-up clamp to align pipe center-on-center so that any inconsistencies in diameter are distributed all around, eliminating the time and damage of hammering. The air-operated studs bring pipe to a perfect circle, mating it perfectly, holding it rock-steady edge-to-edge, ready for a good stringer bead. It's easy to position, fast and easy to use. Available for pipe from 20" thru 36" on a rental basis. For the complete, wonderful details, write or phone . . .

TAR-HEATING KETTLES

PIPE CRADLES

AND: PATCH POTS, BURNERS AND ACCESSORIES. TONGS, SLING BELTS, AND HOOKS, LINE-UP CLAMPS. HAND TOOLS. SUPPLIES AND EQUIPMENT OF EVERY SORT.

GLASS, ASBESTOS AND KRAFT WRAP

ROCK SHIELD

PERRAULT EQUIPMENT COMPANY

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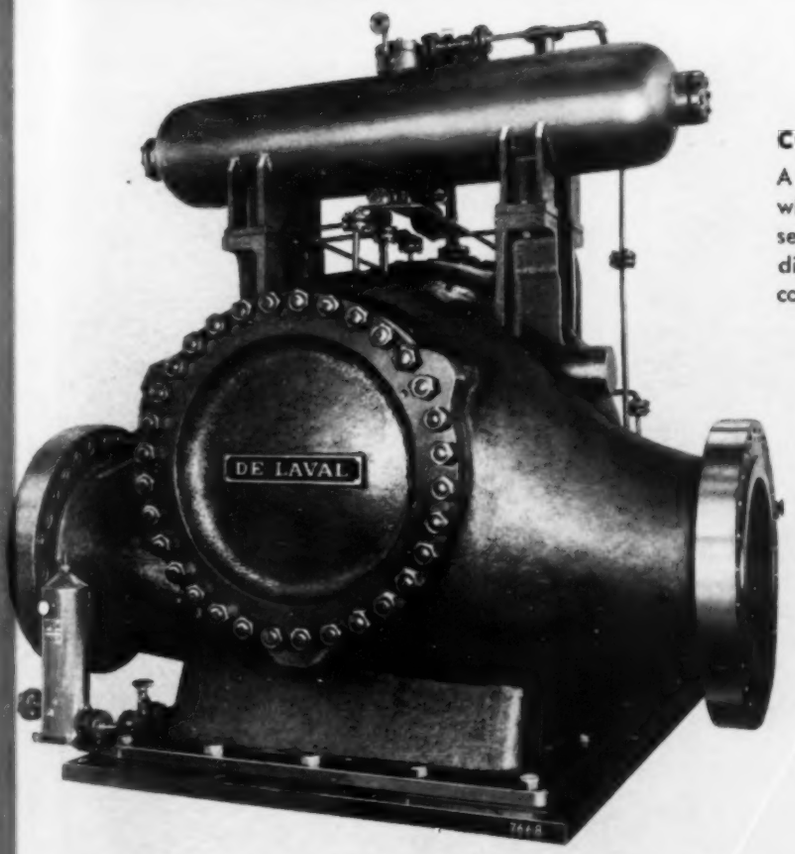
DE LAVAL
CENTRIFUGAL PIPELINE COMPRESSORS

come in two "packages" for easy installation



COMPRESSOR

A De Laval compressor with its emergency seal tank mounted directly on the compressor.

CONSOLE

The console contains the filters, motor-driven pumps, coolers, pressure switches, gauges and other accessories. It eliminates complicated piping on the packaged compressor . . . also serves as a protective cover for the equipment it houses.

Bulletin 503 gives data on De Laval centrifugal pipeline compressors. Write for your copy.

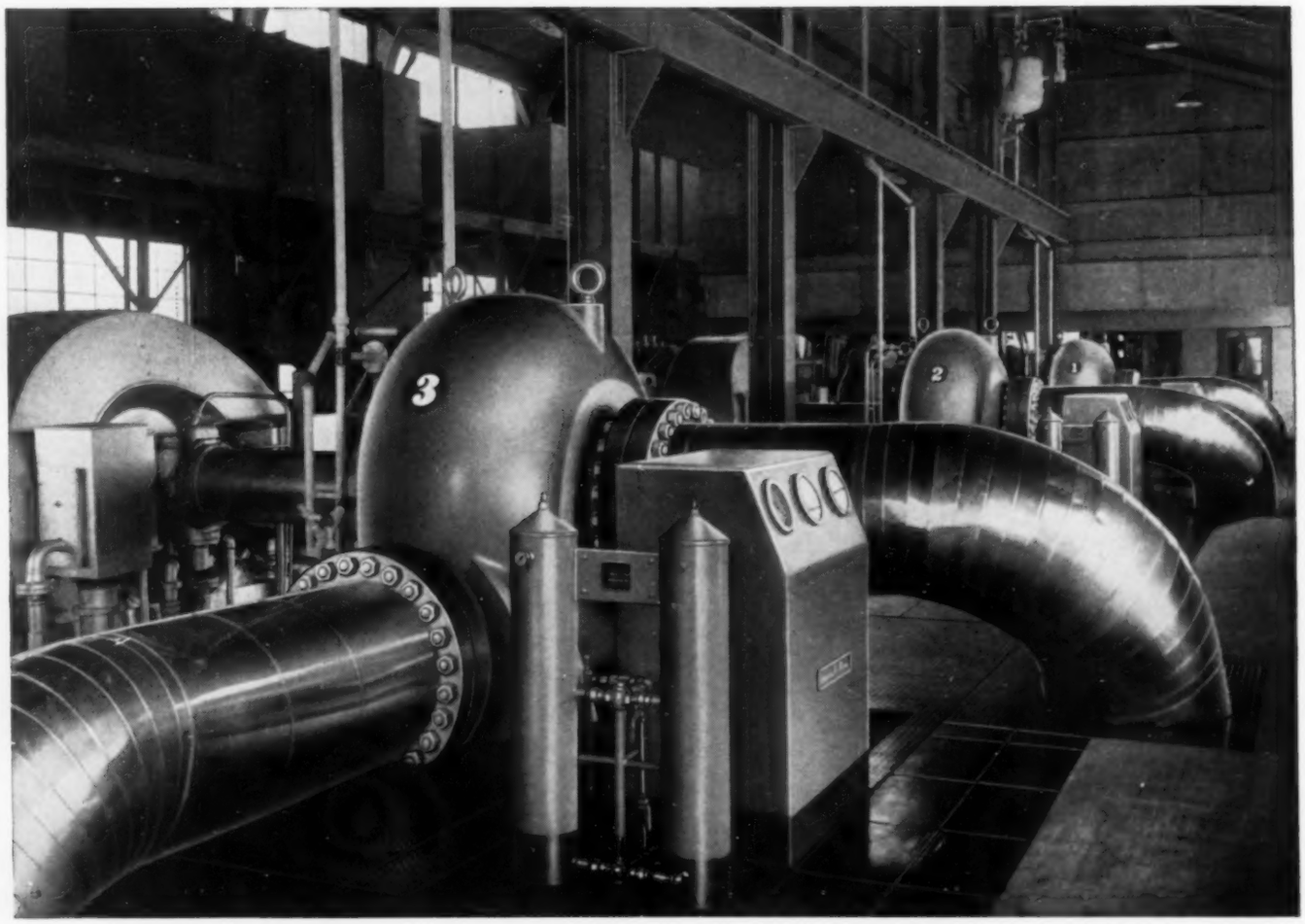
Designed in two packages, rugged De Laval centrifugal compressors offer many important engineering features. Among these are • high pressure contact shaft seal which eliminates gas leakage • heavy and rigid construction throughout • high load carrying capacity. The compressor and console arrangement makes De Laval centrifugal compressors easy to install—only simple low-cost foundations are required. De Laval units, totaling more than 280,000 horsepower, are now in operation on major pipelines.

DE LAVAL *Centrifugal Compressors*

DE LAVAL STEAM TURBINE COMPANY
884 Nottingham Way, Trenton 2, New Jersey

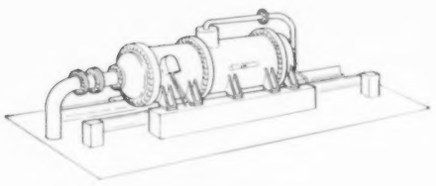
DL-

More than 325,000 of IR CENTRIFUGAL



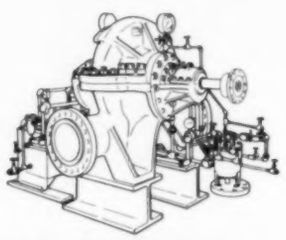
Three of 8 Ingersoll-Rand centrifugal compressors installed on a large natural gas pipe-line. Each unit is driven by a 5000 hp gas turbine.

I-R *"FIRSTS"* in Centrifugal Gas Compressor History



FIRST CENTRIFUGAL PIPE-LINE COMPRESSOR

Built by Ingersoll-Rand in 1931, this centrifugal pipe-line booster consists of a six-stage compressor driven by a 3550 rpm, 3000 hp motor, all encased in a pressure vessel.



FIRST COMMERCIAL APPLICATION

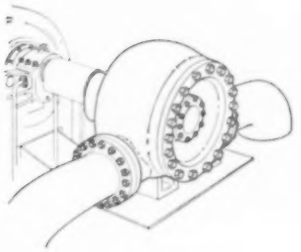
of centrifugal pipe-line compressors was made in 1947. A total of 78 electric-motor-driven, single-stage I-R centrifugals were installed, to handle approximately 250 mmcfd.

horsepower

COMPRESSORS

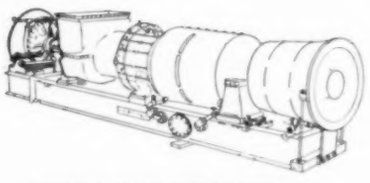
for NATURAL GAS SERVICE

This experience means
MAXIMUM DEPENDABILITY
in modern pipe-line service



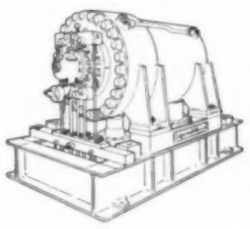
FROM the very first pipe-line installation, Ingersoll-Rand has pioneered in the development of centrifugal gas compressors for higher and higher capacities and pressures. And every step of the way, dependability of performance has been a prime consideration in every detail of design and construction. This is why more I-R Centrifugal Compressors have been sold for natural gas service than any other make . . . a total exceeding 325,000 hp for this service alone.

Backed by such long and successful experience, the modern I-R centrifugal gas compressor is your best assurance of trouble-free performance and long-range economy in gas transmission service.



FIRST GAS-TURBINE-DRIVEN UNIT

Installed in 1949, this Ingersoll-Rand centrifugal compressor, powered by an 1850 hp simple cycle combustion gas turbine, was the first gas-turbine-driven centrifugal compressor developed and applied to pipe-line service, and was designed for a flow of 192 mmcfd at a ratio of 1.18.



FIRST 2000 PSI CENTRIFUGAL GAS COMPRESSOR

This Ingersoll-Rand 5000 hp double-case centrifugal compressor was the first unit ever built for handling natural gas at a discharge pressure of 2000 psi.

Ingersoll-Rand

11 Broadway, New York 4, New York

12-320

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO-BLOWERS • CONDENSERS
CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

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miles of 6, 8, and 10-inch to Yakima and Wenatchee, Eastern Pipeline Construction Company.

Portland Lateral and Columbia River Crossing—16 miles of 18-inch to Portland, River Construction Company.

These are the last contracts to be awarded for construction of the 1487-mile main line and for 477 miles of laterals. The only work for which contracts have not been let is 255 miles of supply and sales laterals to be built in 1957.

Coastal Transmission Plans $60 Million Gas Line

Coastal Transmission Corporation of Houston has applied to the FPC for authority to build and operate a $60 million large diameter natural gas pipe line from the lower Rio Grande Valley of Texas to near Baton Rouge, La., where it will connect with Houston Texas Gas and Oil Corporation's pipe line. The purpose of the proposed new line is to deliver natural gas for ultimate consumption in Florida.

Coastal plans to transport initially an average of 350 million cubic feet of gas daily. The proposed main line system includes 565 miles of 22-inch to 26-inch diameter pipe and 272 miles of smaller diameter laterals connecting approximately 20 gas fields. Four main line compressor stations with a total of 26,000 horsepower will power the system.

According to the application, Coastal has entered into a 20-year gas service agreement with Houston Texas Gas, which has an application pending to transport and sell such gas to their Florida markets.

Court Remands Permission For Texas Eastern's Conversion

The U. S. Court of Appeals has remanded the FPC's certificate authorizing Texas Eastern Transmission Corporation to reconvert the Little Big Inch to petroleum products transportation and construct substitute gas facilities.

George T. Naff, president of Texas Eastern, announced the company will continue to pursue its plans for conversion.

Butane Pipe Line Projects To Be Built on Gulf Coast

Two pipe lines and underground storage systems for butane will be built on the Texas Gulf Coast.

Tennessee Gas Transmission Company's program reportedly includes a 200-mile butane pipe line from the Banquete, Texas, natural gasoline plant west of Corpus Christi to Houston; a $2 million liquid gases separation plant, and an underground storage tank for products. Barge, truck and rail loading facilities are planned on the Houston ship channel.

Butane, propane and natural gasoline will move in a mixed stream to the liquid gases plant where the products will be separated. The Tennessee Gas project is to meet demands of Petro Tex Chemical Corporation's plant in Houston. Proposed storage facilities will be hollowed out of salt domes in the Barbers Hill field.

A similar project is under way by Texas Butadiene & Chemical Corporation. Both butane and isobutane will be stored in salt dome storage wells at Barbers Hill, then piped 14 miles to the company's avgas and butadiene plant under construction.

Today salt water disposal is becoming more and more of a problem among oil operators, due to stringent state regulations and a constantly growing interest in water conservation programs. Pollution of surface and shallow fresh water strata can lead to litigation, higher losses and damages.

The solution of this problem lies in drilling salt water disposal wells and pumping the brine, produced with the oil, back into the formation. A high pressure (1000 lbs.) Wisconsin-Powered pumping unit provides a practical and economical means for handling salt water. The application illustrated here shows a pumping unit connected to a salt water disposal well with 2" fittings and pressure gauge. Pumps are made of aluminum bronze, stainless steel, ceramic material, lead bronze, etc., in order to stand up under this varying type of service.

Dependable, all weather power is delivered by a Model VF4D and VG4D Wisconsin V-type, 4-cylinder, heavy-duty AIR-COOLED ENGINE, equipped with Stellite exhaust valves and valve seat inserts, positive type valve rotators, tapered roller main bearings and other features that assure trouble-free service and lowest cost maintenance.

You can't do better than to specify "WISCONSIN POWER" for your equipment.

WISCONSIN MOTOR Corporation
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

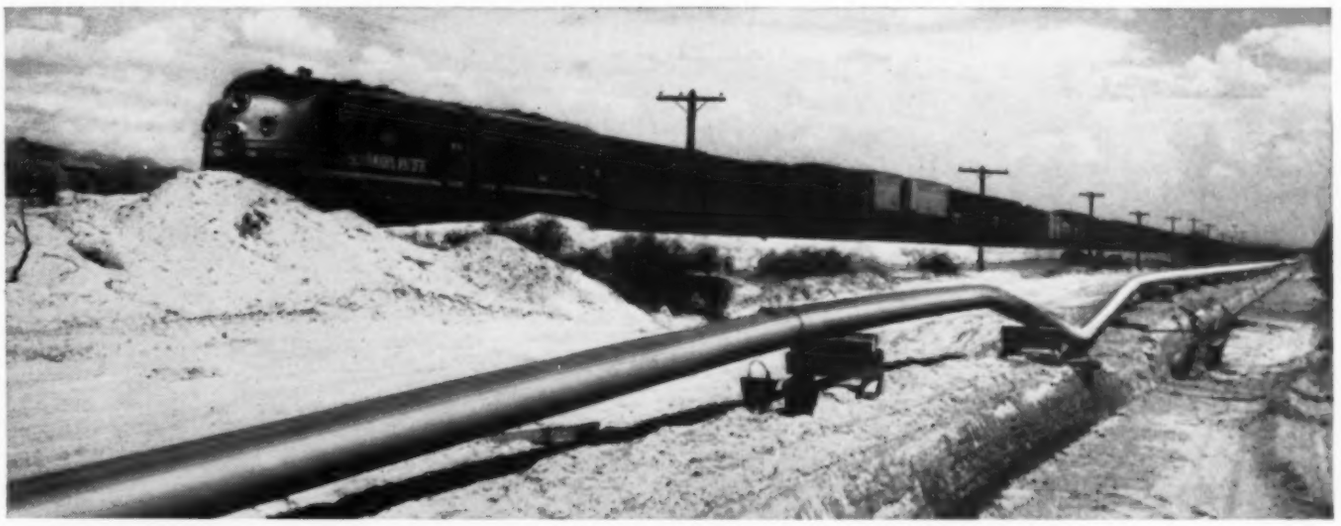
WRITE TO HARLEY SALES CO.
619 SOUTH MAIN STREET • TULSA, OKLAHOMA
3420 McKINNEY AVENUE • HOUSTON, TEXAS
505 SOUTH MAIN STREET • WICHITA, KANSAS
OIL FIELD DISTRIBUTORS FOR WISCONSIN ENGINES AND ALL TYPES OF UTILITY UNITS

A 8563-½-I

$30,000,000 Southern Pacific Pipeline

SOUTHERN PACIFIC COMPANY, one of the world's largest transportation systems, is the first railroad to build a major pipe line. Construction of this 844-mile line was handled by Southern Pacific Pipe Lines, Inc.—a subsidiary.

rushed to completion



PIPE LINE EXTENDS from Watson, Calif. to El Paso, Texas. Products moved are gasolines, diesel oil and jet fuels. Kaiser Steel line pipe measures up to 52 rigid tests to be sure it meets every requirement on jobs such as this.

SEVEN contractors laying pipe on eight spreads rushed this first Southern Pacific pipe line to completion in 9 months.

Working closely with them was Kaiser Steel, the major supplier of line pipe. Careful planning to make *sure* that top-quality pipe is available when and where it's scheduled is an important part of Kaiser Steel's service to pipeliners.

Next time you are ordering line pipe, think of Kaiser Steel. Rely on Kaiser Steel quality and service to add dollars to your operating profits.

Kaiser Steel

Steel Mill Products: plates • hot rolled strip and sheet • cold rolled strip and sheet • tin plate • continuous weld pipe • electric weld pipe • alloy and carbon bars • bar shapes • structural shapes semi-finished steels • pig iron • ingot molds • coke by-products • **Fabricating Division:** steel fabrication for construction, aircraft, missile and other industries • expanded fusion weld pipe reinforced concrete pipe • tanks • For specifications, write: **KAISER STEEL CORPORATION** • **Los Angeles** • **Oakland** • **Seattle** • **Portland** • **Phoenix** • **Denver** • **Tulsa** • **New York**

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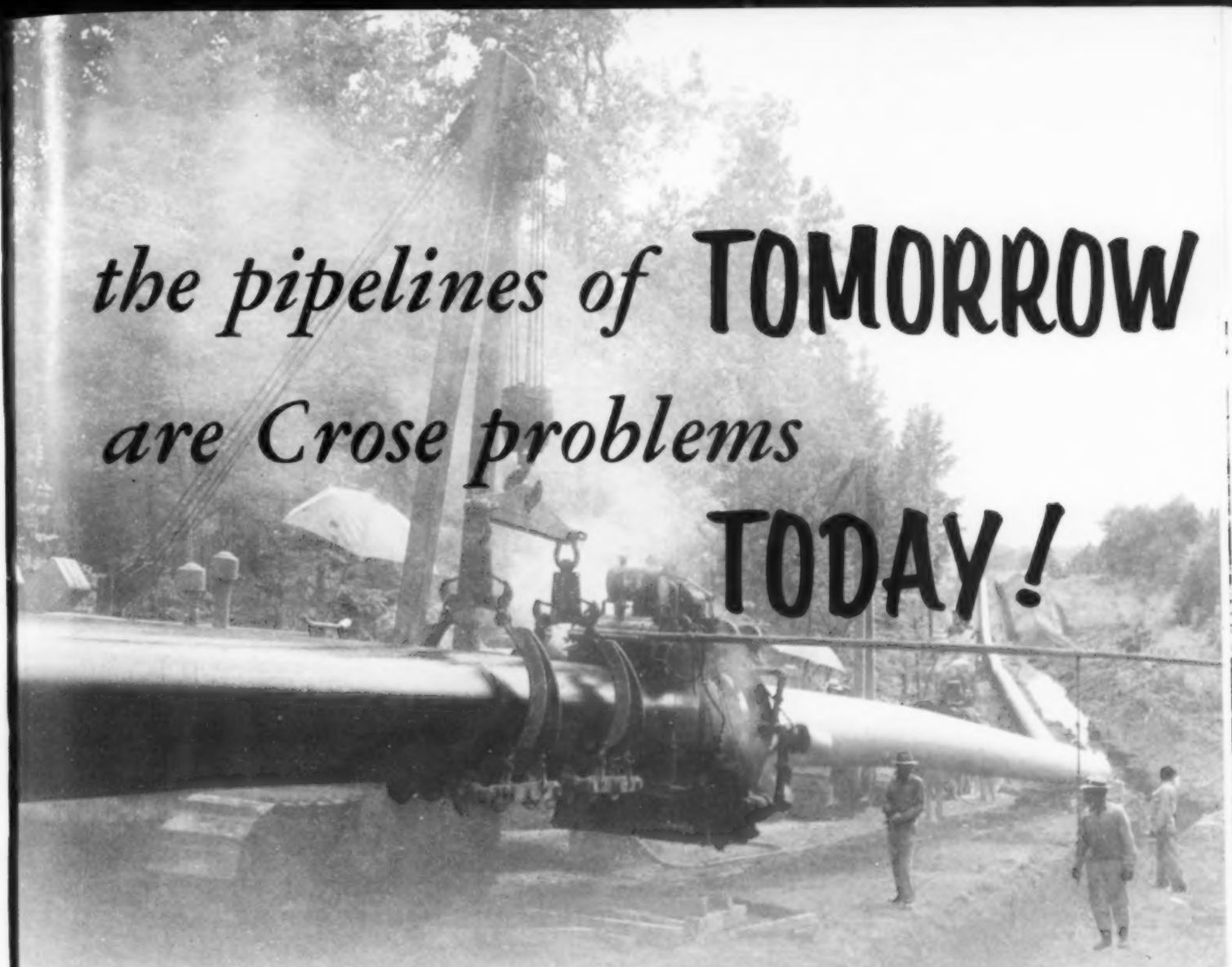
Proposed Pipe Line Construction

COMPANY	Length in Miles	Diameter	Type	Origin and Terminus	Estimated Cost	Status
Alabama-Tennessee Natural Gas Co.—Florence, Ala.	21	8, 12	Gas	Colbert County, Ala. loop.	$808,450	Authorized
Alberta Gas Trunk Line, Ltd.	547	6-34	Gas	From Alberta fields to western terminus of Trans Canada Pipe Line, Ltd.	$47 million	Approved
American Gilsonite Co.	80		Gilsonite Slurry	Bonanza, Utah—Western Colorado, refinery	.....	Considered
American Pipe Line Corp.—New York City (Swinerton & Walberg, Engineering)	1,425	24, 26	Products	Beaumont, Texas area—Newark, N.J., plus 485 miles of laterals.	$170 million	Approved ODM
Arkansas-Louisiana Gas Co.	66	24	Gas	Arkansas, Louisiana and Texas loops	$9,245,166	Authorized
Atlantic Seaboard Corporation	86	20, 26	Gas	In West Va. and Va. paralleling sections of the company's existing line and extending from Seaboard's Lost River compressor station to its Bickers compressor station interconnecting the company's lines.	$8.5 million	Before FPC
Big Horn Pipe Line Co.—Cheyenne, Wyo.	150	8	Crude	Ash Creek, Wyo. field—Midwest, Wyo.	.....	Considered
California-Oregon Pipe Line System	103	6	Crude	Crescent City, Calif.—Medford, Ore.	$2 million	Planned
Central Kentucky Natural Gas Co.	24	20, 24	Gas	Cold Springs—Anderson Ferry, Ky.	$2.5 million	Authorized
Chaco Pipeline & Refinery Corp.	450	....	Products	From Glenn McCarthy's Bolivian wells to new refinery at Conception, Paraguay	.....	Before FPC
Cities Service Gas Co.—1st National Bank Bldg., Oklahoma City, Okla.	15.5	16	Gas	Various locations in Kansas and Oklahoma	.....	Planned
Coastal Transmission Corp.—Houston, Texas	565	20-26	Gas	McAllen, Texas—Louisiana connection, Houston, Texas Gas, plus 272 miles of laterals	$60 million	Before FPC
Colorado Interstate Gas Co.	380	22	Gas	Green River, Wyo.—Denver	.....	Authorized
Compania Shell de Venezuela	177	20	Gas	La Paz field to Cardon refinery on Paraguana peninsula	$20 million	Planned
Consolidated Gathering Systems, Ltd.	198	....	Crude	Sturgeon Field—Edmonton.	.....	Planned
Consolidated Natural Gas Corp.—New York	112	....	Gas	In Ohio—Plus other smaller lines	$6 million	Planned
Cosden Petroleum Corp.—Big Spring, Texas	100	6	Products	Big Spring—Abilene, Texas	$1.5 million	Contract let
Deep Rock Gas Co.	120	6	LPG	Tioga, N.D.—Canadian border	.....	Planned
El Paso Natural Gas Co.—El Paso, Tex.	414	34	Gas	Parallel from San Juan Basin to Topock, Ariz.	$194 million	Authorized
El Paso Natural Gas Products Co.	240	8	Products	Midkiff natural gasoline plant in Permian Basin to El Paso	.....	Planned
Freedom-Valvoline Oil Co.	34	8	Products	Harpster—Findlay, Ohio	$700,500	Planned
Houston Texas Gas & Oil Co.—4604 Main St., Houston	961	12-30	Gas	Baton Rouge, La.—Miami, Fla.	$110 million	Before FPC
Iraq Petroleum Co.	75	24	Crude	Homs, Syria to Tripoli, Lebanon	.....	Considered
Iron Ranges Natural Gas Co.	115	....	Gas	From Itasca and St. Louis Counties along route of Mesabi range from Grand Rapids to Aurora, Minn.	$5 million	Before FPC
Magna Pipeline Company	40	....	Gas	Underwater line from Anacortes, Wash. to Victoria	$6 million	Planned
Malco Pipe Line, Inc.	91	6	Products	Prewitt, N.M.—Albuquerque	$1,250,000	Considered
Manufacturers, Gas, Light, and Heat Co.	72	16-20	Gas	Doddridge, Wetzel, and Marshall Counties, W. Va.	.....	Planned
	213	3-26	Gas	Various locations in Pa., W. Va., and Ohio	.....	Planned
	40	....	Gas	Allegheny, Washington, and Beaver Counties, Pa.	.....	Planned
Michigan-Wisconsin Pipe Line Co.—500 Griswold, Detroit	252	4-24	Gas	Various locations in Illinois and Wisconsin	$11 million	Planned
Midwestern Gas Transmission Co., Houston, Texas	1112	....	Gas	Emerson, Manitoba—Nashville, Tenn.	$98 million	Before FPC
Montana-Dakota Utilities Co—Minneapolis	44	....	Gas	Various locations in S.D. and Wyoming	$1.4 million	Authorized
	41.8	12	Gas	Williams County, N.D.	$1.4 million	Authorized
NATO	1920	4-10	Products	To serve military bases in Western Europe	.....	Foster-Wheeler Prime Contractors, 875 miles let
Natural Gas Pipe Line Co. of America—20 N. Wacker Dr., Chicago	350	20, 26	Gas	Wise County, Texas—Fritch, Texas	$28.5 million	Authorized
	480	30, 36	Gas	Loops at various points along existing line	$80 million	Before FPC
New York State Natural Gas Corp.	56.5	30	Gas	Tioga County, Pa.	$7 million	Before FPC, 12 miles Authorized
North Carolina Natural Gas Corp.	575	3-16	Gas	Mooresville eastwardly across North Carolina	$13 million	Authorized
Northern Natural Gas Co.—2223 Dodge St., Omaha	167	24	Gas	Farmington, Minn. to Duluth, Minn. and Superior, Wis.	$12 million	Before FPC
	....	....	Gas	To interconnect with Natural Gas Pipe Line	$244,000	Planned
	28.4	30	Gas	Test lines to underground storage near Redfield, Iowa	$4.8 million	Before FPC
	15	24	Gas	To main line in Nebraska	.....	Before FPC
	163	10, 12	Gas	Various locations in South Dakota, plus 307 miles of branch lines	.....	Before FPC
	6	6	Gas	Iowa loop and compressor additions in Texas	$760,000	Before FPC
Northwestern Utilities, Ltd.—10124-104th St., Edmonton, Alberta, Canada	42	12	Gas	Bonnie Glen—Edmonton, Alberta	$1.4 million	Planned
Offshore Gathering Corp., Houston	364	24, 26, 30	Gas, Crude	Texas side of Sabine River 25 miles offshore La. to Mississippi side of Pearl River	$150 million	Before FPC
Pacific Gas & Electric Co.	150	34	Gas	Various loops, between Topock, Ariz.—Milpitas, Calif.	$4 million	Planned
Pacific Northwest Pipe Line Corp.—M & M Bldg., Houston	1,487	22, 26	Gas	San Juan Basin—Pacific Northwestern states and Canadian border terminus near Sumas, Wash. plus 732 miles of supply and sales laterals	$246 million	Contracts let for main line and 477 miles of laterals
Petroargentina	370	16	Crude	Newguen—Bahia Blanca, Argentina	$40 million	Planned
Petroleos Mexicanos—Ave. Juarez, 94, Mexico City	440	20	Gas	Brazil—Tampico—Poza Rica, Mexico	.....	Planned
	145	12	Crude	18 de Marzo Field—Monterrey, Mexico	.....	Considered
	80	8	Products	Guaymas—Los Mochis	$1 million	Planned
Phillips Petroleum Co.—Bartlesville	54	6	Products	Goldsmith—Borger, Texas	.....	Planned
	50	....	Ethylene	Sweeny—Pasadena, Texas	.....	Planned
	22	20	Gas	Roberts County, Texas, to Rock Creek gasoline plant	.....	Approved
Pioneer Natural Gas Co.	261	3-22	Gas	Various locations in Texas Panhandle	.....	Planned
Plantation Pipe Line Co.	327	18	Crude	Baton Rouge, La. to Helena, Ala.	$23.5 million	Contract let
South Alberta Pipe Line, Ltd.	46	10	Gas	Etzikom Field—Medicine Hat, Alberta	$1 million	Planned
Southern Calif. Gas Co. and Southern Counties Gas Co.	278	30	Gas	Topock, Ariz.—Newhall	$31 million	Planned
Southern Natural Gas Company	52	....	Gas	Various locations in Ga. and La.	$2.2 million	Authorized
Standard Pipe Line Co.	330	16	Crude	Wink, Texas—Albuquerque, N.M.	.....	Before ODM
Stanmount Pipe Line Co.	140	10	Crude	Cayiga and Beaver Lake Fields, N.D. to connect with Interprovincial Pipe Line	.....	Planned
Sturgeon Pipe Line Ltd.	100	12	.....	Sturgeon Lake Field—Trans-Mountain system	$6,500,000	Planned
Sun Pipe Line Company	110	14	Products	Marcus Hook, Penn., to Newark, N.J.	.....	Planned
Sunflower Pipe Line Co.—Tulsa, Okla.	265	3-6	LPG	Kearny, Grant and Haskel Counties, Kansas—Wichita, Kansas	$3.5 million	Authorized
Tennessee Gas Transmission Co.—Box 2511, Houston (See also Midwestern Gas Transmission Co.)	220	26, 30	Gas	Loops in Kentucky and Ohio plus 376 miles of Supply laterals in Texas and Louisiana	$56 million	Authorized
	100	....	Gas	Gathering lines in Texas and Louisiana plus station additions	$18.6 million	Before FPC
	1,050	....	Gas	Border near Emerson, Manitoba—Nashville, Tenn.	$98 million	Before FPC
	162	....	Gas	Loop Lines in Kentucky, Ohio, and Pennsylvania	$24.3 million	Before FPC
	200	....	Butane	Banquette, Texas, natural gasoline plant to Houston	.....	Planned
Texas Eastern Transmission Corp.	422	30	Gas	McAllen to Vidor, Texas	Estimated	Planned
	530	30	Gas	Loops at various points between Kosciusko, Miss. and Uniontown, Penn.	Cost of Entire Project	Planned
	45	24	Gas	Provident City, Texas crossover to McAllen-Vidor line	$150	Planned
	135			Supply and delivery lines laterals	Million	Planned
Texas Eastern Transmission Corp. and Texas Eastern, Penn-Jersey Corp.	11	....	Gas	Loops in Philadelphia area plus compressor facilities	$2.4 million	Authorized
Texas Gas Transmission Corp.	198	20	Gas	East Lake Palourde Gas field, La. to Eunice, La. and loops paralleling existing system in Arkansas, Mississippi, Tennessee, Kentucky, Indiana	$20 million	Authorized
	....	....	Gas	Houston, Texas—Miami, Fla.	.....	Considered
Trans-Canada Pipe Line, Ltd.—Calgary, Alberta	2240	30, 36	Gas	Alberta—Eastern Canada	$297 million	Planned
Transcontinental Gas Pipe Line Corp.—3100 Travis St., Houston	....	....	Gas	Connecting facilities with Texas Eastern Penn-Jersey in Pennsylvania and New Jersey	$131,628	Authorized
	24.2	....	Gas	Gathering Lines from South Bayou Mallet, Maxie and Happytown Fields, La.	$754,000	Authorized
	12	....	Gas	Live Oak gas field, Vermillion Parish, La. plus two meter stations	$707,000	Before FPC
United Gas Pipe Line Co.	63	16, 20	Gas	Various locations in Miss., Ala. and Florida	$10 million	Authorized
United Natural Gas Co.	50	12	Gas	Elk County—Jefferson County, Pa.	.....	Planned
U. S. Navy	450	8	Gas	Gubik Field—Fairbanks, Alaska	$20 million	Planned
Washington Gas Light Co.—Washington, D.C.	11	24	Gas	Chillum Station—Gordon's Corner, Md.	$2 million	Authorized
Westcoast Transmission Company, Ltd.	270	8-26	Gas	Various locations in Peace River region	.....	Planned
Wilcox Trend Gathering System, Inc.	16	16	Gas	Gathering lines to Provident City, Texas	$2.9 million	Before FPC
Winnipeg and Central Gas Co.	450	4-8	LPG	Tioga, N.D.—Winnipeg, Canada	$20 million	Planned



the pipelines of TOMORROW *are Crose problems* TODAY!

Crose engineering and research is constantly working to develop new and better pipeline construction equipment. The 36" cleaning and priming machines — coating and wrapping machines used on the Transcontinental Gas Pipeline job were the result of Crose engineering and research. The machines, largest of their kind, show the forward thinking of Crose designers. Whatever equipment tomorrow's pipelines will demand — you can bet that Crose will build it.

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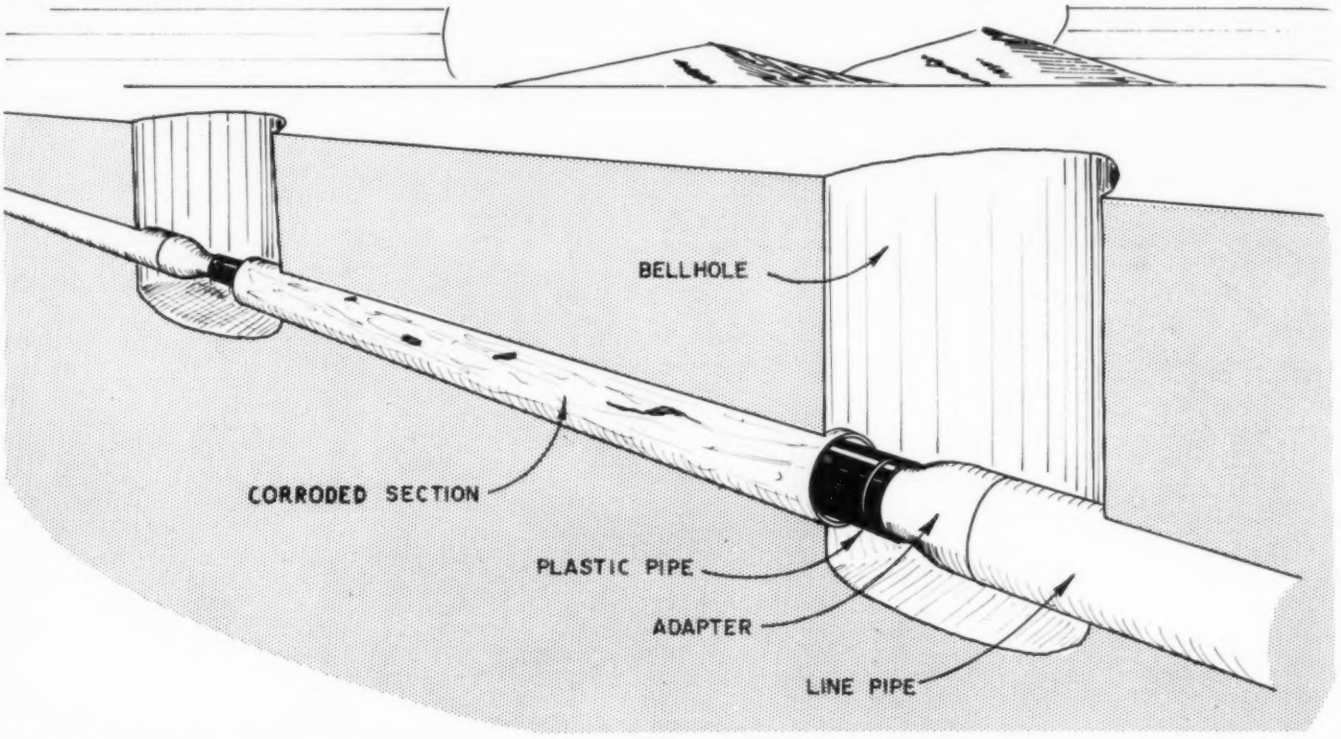
How to do it

PIPE LINE HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, PIPE LINE INDUSTRY, P. O. Box 2608, Houston 1, Texas



Plastic Pipe Used in Repairing 'Hot Spots' Decreases Costs

A good way to decrease cost of repairing corrosion "hot spots" is by installing a plastic pipe of smaller diameter inside the "hot spot" section. Gas companies have been using this idea on small, low pressure lines, but recently oil companies in Illinois applied the plastic liner with satisfactory results.

Installation of the plastic pipe is especially good where the corroded section is under a highway or an inaccessible location. It is possible to push approximately 500 feet of plastic through a steel pipe where the section is reasonably free of sags or bends.

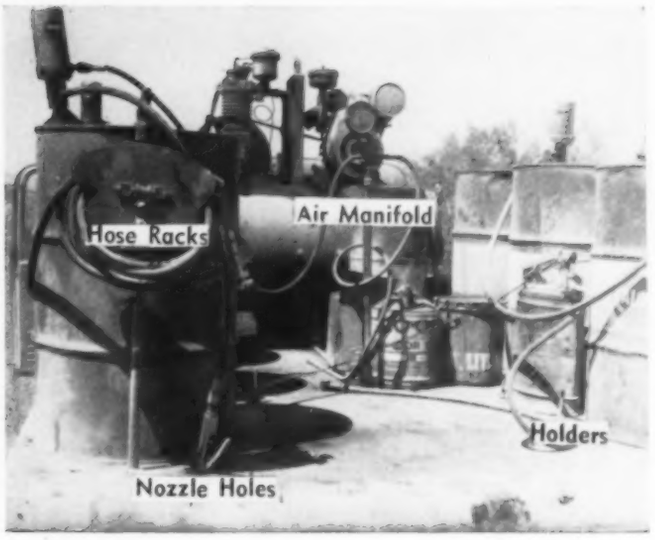
Bellholes are dug at each end of the corroded section. By removing approximately four feet of steel pipe at each end of the section to be replaced, plastic pipe of a smaller diameter can be joined together, pushed through the steel pipe and made up into the line through the use of adapters.

Junk pipe is left in place to serve as a protective casing for the plastic. This eliminates the stripping out and removal of the old pipe. Salvage labor is cut in half and repair time for the replacement of bad sections of pipe is greatly reduced.

Shop-Made Enamel Kettle Speeds Maintenance Work

Applying hot enamel in repair work is much easier with the help of the shop-built enamel kettle shown. The frame is fabricated with short pieces of light weight "I" beams as horizontal side members. This is supported by an underframe made of short pieces of scrap pipe. A pair of discarded truck wheels and tires make up the wheel assembly.

Quick mobility is provided by a safe hitch. A V-member in front has a piece of flat steel plate welded to it in a horizontal position to serve as a hitch. A short length of chain adds safety during travel. Hitching and unhitching is facilitated with the use of the adjustable vertical leg shown. The leg is detachable.



Efficient Lube Unit Services Construction Equipment

Here is a special-equipment service truck that helps one pipe line contractor service equipment along the right-of-way quickly.

An air-cooled engine-driven air compressor is mounted above the receiver tanks. Spaces are provided for six 55-gallon drums. Two tie-down rods on each side coming up from beneath the floor secure the drums.

The truck bed is kept clean of oil drippings by inserting hose nozzles into holes cut through the bed. Short lengths of steel bar welded to the truck bed at convenient places provide holders for smaller containers.

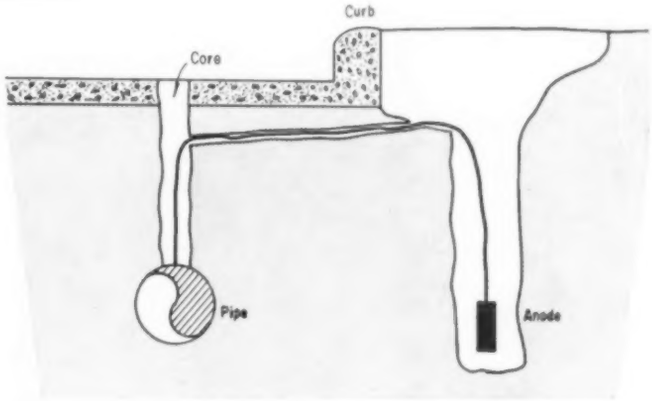
An air supply manifold mounted at a convenient height in the forward center area of the truck facilitates pumping lubricants from the various drums. By means of this manifold only short lengths of hose are needed to service all drums. Hose racks mounted near the end of the bed provide for fast coiling and uncoiling of the compressor hoses.

Core Drill Cuts Cost, Speeds Installation of Anodes

Using a small core drill to make anode holes will reduce traffic interference to a minimum. A gas distribution company installed 150 anodes in a 3000-foot section of 12-inch bare steel main in half the time normally required.

First the concrete core was cut using a core drill, and remainder of hole was made with a post hole digger. Pipe was cleaned thoroughly using a rotary air drill with wire brush attachment on long shaft. Anode lead was attached using a standard thermite welder on an extended handle.

A hole was dug between the curb and sidewalk and another hole punched between the first and the anode hole through which the anode lead was "fished." The



backfill was replaced, the core put in place and recemented.

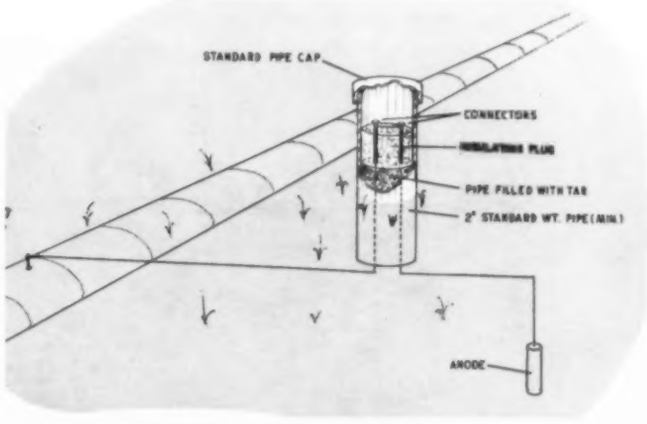
Cost of cutting and restoring pavement was reduced by more than $10 per installation.

Scrap Pipe Riser Keeps Anode Test Lead Handy

This well-designed anode riser enables pipe line corrosion survey readings to be taken quickly. The jumpers between the connectors can be taken loose, the anode disconnected from the pipe and readings can be taken easily. A shunt replacing the jumper enables quick measurement of the current output of the anode.

A plastic plug is inserted as shown to serve as an insulator and also to keep the connection dry.

The cover pipe is made of 2-inch standard weight pipe or larger as needed. A standard 2-inch pipe cap keeps the rain and bugs out of the riser. Some pipe dope on the threads will keep out moisture.



A PICTURE REPORT OF HOW

River Construction Co.

speeds important new 150-mile gas line

River Construction Co., Fort Worth, Texas, is now laying an important new line which will send natural gas from the San Juan Basin, Colorado, to the industrial areas of the Pacific Northwest. Their first contract calls for 150 miles of 26-inch line between Ignacio, Colorado, and Moab, Utah. Large photo at right shows two of the company's International TD-24's with Superior Booms lowering a 200-ft section of pipe across an irrigational canal. Note how two-way powered line enables operator to inch this long, heavy section into place without danger of slipping. All controls are grouped for operator's convenience and safety.

At bending machine, River Construction Company uses another International tractor—this TD-18A with Superior Boom. Fast-maneuvering unit carries pipe so rapidly to and from bending machine it has time to transport River's 200 and 300 amp welders from place to place, as needed.

For doping and wrapping, another International TD-24 with Superior Boom carries weight of pipe, pulls dope and wrap machine, *and*, at same time, tows heavy, crawler-mounted dope pot!

To prevent scattering of blasted rock over farm fields, TD-14A dozes dirt over dynamite. Explosion expends force moving dirt; rock stays within right-of-way.

Final cover is handled by TD-14A with bucket-backfiller. Operators say they like the easy, effortless control and good all-around vision of both tractor and bucket.

Hand-patching is handled by this TD-18A tow tractor and crew. Model shown develops 102 bhp . . . 89 drawbar . . . pulls 22,850 lbs in first gear . . . has 6 speeds up to 5.7 mph.

To prevent damage before final backfilling, two International Drott TD-14A Skid-Shovels place blanket of rock-free earth around pipe. These rigs develop 66 dhp, handle 3 yds per load.

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. . . a payload . . .

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Lift capacities increased 20 to 62%

	TD-24	TD-18A	TD-14A	TD-9
Lift capacity of New Superior Booms*	110,000	70,000	30,300	16,000
Lift capacity of '54 models*	90,000	43,200	24,300	13,440
New Superior Booms give you these per cents of increase	22%	62%	25%	20%

*Figures show maximum lift in lbs at 4' overhang

TRACTION and CLEARANCE

for rough or soft terrain

DIGGING ABILITY

to trench fast and deep

Tractor-type treads on Bucyrus-Erie dragshovels bring new traction and mobility to pipeline trenching. Ten years of development has resulted in high clearance, improved lubrication, strong parts, wide bearing area, and long track life. You can climb grades up to 35 per cent with adequate footing, move more easily over soft, swampy ground, and save travel time in rocky, rough terrain. Here is dragshovel mobility that's tailor-made for rugged pipeline duty.

With a Bucyrus-Erie dragshovel you get high speed on the hoist and swing, great power on the digging stroke, too, for maximum output. The heavy boom adds power to digging strokes, helps dipper penetrate easily even at maximum depth and reach. Dipper has sloping sides, straight cutting edges on side cutters, and extended lip area for clean trenching, easily-heaped loads.

See your Bucyrus-Erie distributor soon . . . and get all the facts on these popular favorites of pipeline contractors — the ½-yd. 15-B and ¾-yd. 22-B dragshovels. 120E55

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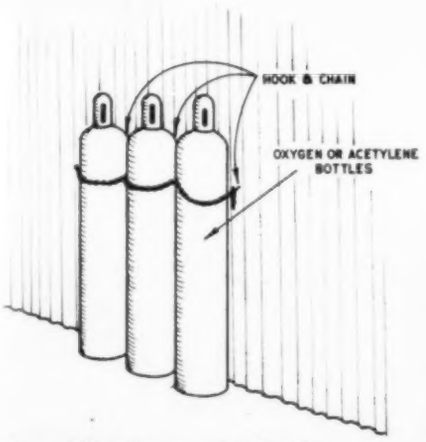
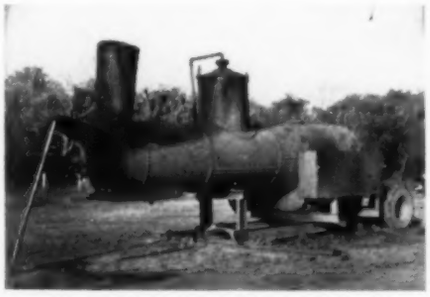


Eye Hooks and Chain Secure Bottles on Wall

One good way to assure safety in storage of oxygen and acetylene bottles is to secure them to the wall with several eye hooks and a chain. Hooks can be inserted either on the outside of all bottles or between each bottle and about 2½ feet off the floor.

This device eliminates any possibility of the bottles being knocked over and causing injury. Cost of installation, less than a dollar, is very inexpensive insurance.



Mobilize Boiler For Pipe Clearing

An oil field boiler can be modified to provide steam and heat for cleaning and reconditioning around a temporary pipe cleaning yard. Make a connection for the "fifth wheel" on a plate which is fitted to the underside of the tube section of the boiler to hook onto a truck tractor.

Mount the trailer wheels to the firebox under channel beams running lengthwise and crosswise as shown. Risers fitted to the front of the beams support the tube section of the boiler. Tool boxes on each side of the boiler provide storage space for connections and tools.

Fold-Away Vise Bench Is Handy on Truck Bed

Frequent need for a small work bench and vise on a pipe line spread can be met by fitting a sturdy all-steel bench to the rear of an A-frame truck.

Construct the bench of a 12-inch by 39-inch piece of heavy steel and

support it by curved strap iron brackets fitted to the rounded end of the truck bed. The bench can be tilted onto the bed for traveling.

Brackets are hinged by a length of one-inch steel tubing through which runs a three-quarter-inch cold rolled round steel bar. Steel rings welded to the truck bed anchor the bar ends. Bolt the vise to one end of the bench as illustrated.

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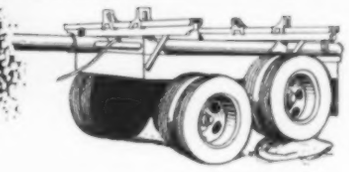

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AUGUSTA KANSAS

Please send me information on your
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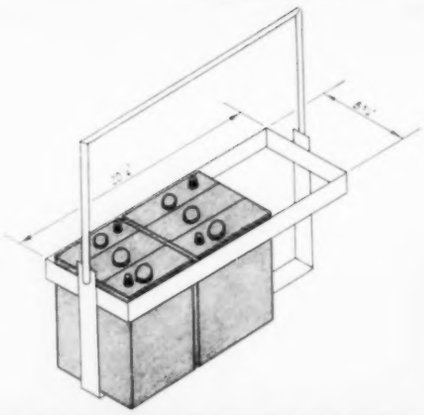
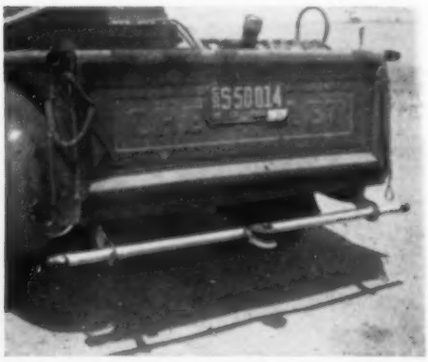
Metal Holder Useful For Carrying Batteries

Removing and placing batteries in cars and trucks can be made easier when using a battery holder such as the one illustrated. This carrier is designed for medium and heavy weight storage batteries not equipped with handles.



Batteries are easy to carry in this holder and its use cuts down on the possibility of dropping the battery. The carrier is especially useful for batteries carried by mechanics and gagers as boosters. The device is easily constructed with a frame of 1 gage metal and a handle of one-half inch pipe. It can easily be made by a welder between jobs.

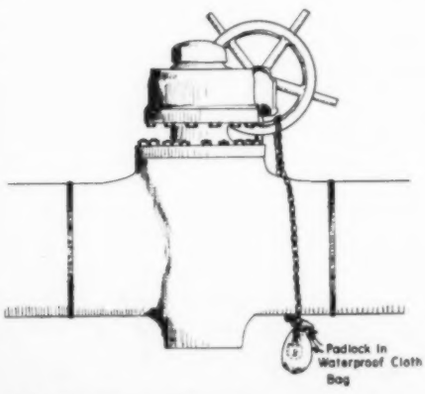


Bumper-Trailer Hitch Is Easy to Construct

A durable and economical bumper-trailer hitch can be made with little effort or expense.

This trailer hitch can be made from a discarded 1½-inch oil well pump plunger or some round scrap stock and ¼-inch steel plate. The plunger is cut to length and spot welded to brackets made of ¼-inch steel plate bolted to the frame of the truck.

The hitch consists of two pieces of plate about five inches long and three inches wide. These are welded one above the other, at the center of the plunger. A one-inch hole is burned through both pieces to allow a pin or ball hitch to be installed.



Cloth Bags Protect Locks from Weather

By using small waterproof cloth bags about 4 by 5 inches, padlocks on outdoor block gate valve boxes, scrap-

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EIGHT-DAY ARCCO CHARTS are now available for use on practically all Rockwell-Emco, Foxboro and Westcott orifice meters. Eight day charts for other instruments soon available.
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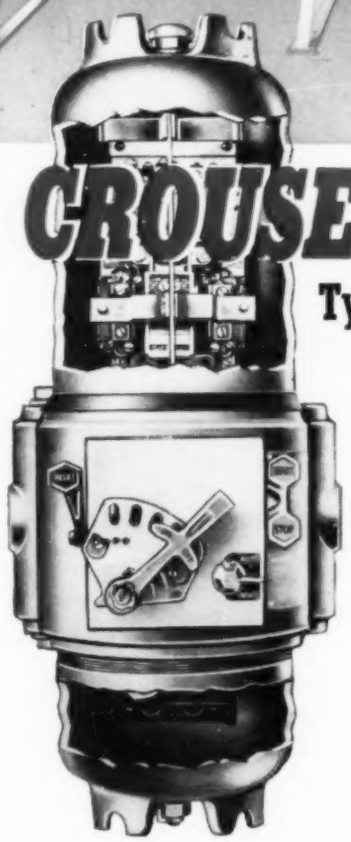
33 – count them – 33 Crouse-Hinds' combination starters and circuit breakers . . . space for 2 more for later installation . . . plus 2 circuit breakers —all in 28' x 10' of space! Conventional single-tiered installation would have required 20 ft.-longer rack and 4 more junction boxes.



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Type EPC Explosion-Proof MOTOR STARTER and CIRCUIT BREAKER

CONDULETS* take up less space!

As in the installation shown above, a given area will hold *more* Crouse-Hinds' motor controls than any other make. You save money on the construction of steel mounting racks – fill your needs without occupying additional premium floor space.

- Explosion-proof, dust-tight, weather-resistant.
- Light-weight cast aluminum for easy installation without lifting equipment.
- Flame-tight threaded joints throughout.
- Seven conduit entrances simplify installation.
- Built-in push button stations and built-in selector switch available.
- Starter sizes 0 to 5. Circuit breakers 50 to 600-amp. frame sizes.

Let Crouse-Hinds help you solve your space problems. Engineering assistance available without obligation.

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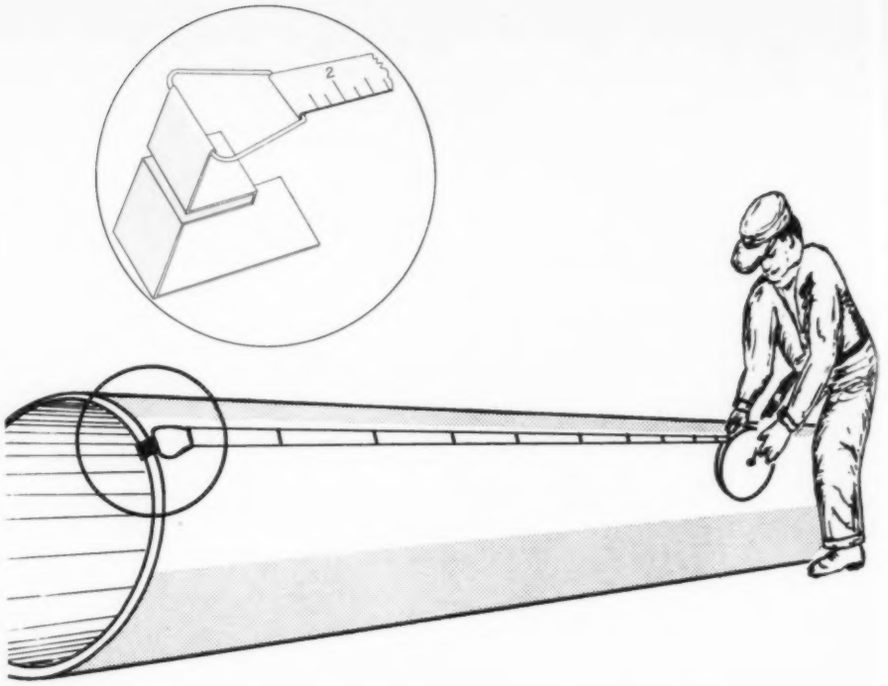
per traps, and rectifier covers are protected from freeze-ups.

The accumulation of ice, snow and dust which sometimes makes locks inoperative may be easily knocked off the bags. For a cost of about five cents per installation, the bags save work and time which may be especially important in case of an emergency.

A pipe line company who used the bags in Montana estimated a savings of $125 for labor and padlock replacements at a cost of five cents.

The chain around the valve wheel is locked in a normal manner and the waterproof cloth bag is tied on as shown.



Make Dashboard Shelf For Handy Chart Storage

This simple shelf installed beneath the dashboard of a field truck will keep charts handy for field men. Made of galvanized metal, the compartment is fastened to back of firewall and underside of the dash. Ends are bent to form the sides. Two holes

on each side match holes drilled in the bottom of the dash and allow for stove bolt fastening.

Charts in the container are kept clean and ready for quick use.

Hook-on Tape Speeds Up Measurement of Pipe

This simple idea will have a great deal of time and effort when it is necessary to measure joints of pipe while working alone.

The hook is made of light gage sheet metal which has been bent as shown in the insert and fastened to the end of the tape. Wire may also be used to make the hook.

Such a device may also be used in measuring sheet metal or lumber.

made for rugged use...
in plant—office or field

Gotkool
water cans and coolers

"GOTKOOL" Water Cans are easily portable for field use . . . and "GOTKOOL" Water Coolers are especially designed for use in office, store, or plant. Both have extra large top openings. Snug-fitting, easily removable tops protect water from impurities. Heavy construction with heavy double-locked, sweat-soldered seams. *Buy* "GOTKOOL" *at your supply store today.*

GOTKOOL Water Cooler — made in 2, 3, 5, 8, 10, 15, and 20-gallon sizes with extended or recessed flush-mounted faucet optional. *(Note: 15- and 20-gallon sizes available with extended faucet only.)*

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ROSS EXCHANGERS
make lube oil temperatures *behave* in Buda oil field engines

On the job in a Texas oil field, this Buda natural gas engine drives a pipe line gathering pump.

Like other Buda engines at work in major oil fields around the world, it's equipped with a Ross Type BCF Exchanger. Close clearance engine parts are sure to receive their full share of lube oil at proper temperature under all conditions. The Ross Exchanger cools oil at high loads and heats oil at light loads to assure uniform temperature and a continuous flow of oil through the filters.

In every corner of the oil and gas industry, Ross Exchangers are not only favored for engines, compressors and other prime equipment, but also for the more specialized distillation units themselves . . . wherever there is a heating, cooling or condensing requirement.

One reason for such widespread acceptance: Top rated thermal efficiency. Another: Unchallenged ruggedness.

But the clinching factors are Ross pre-engineering and standardization in a broad range of sizes to meet most needs.

For more information, request Bulletin 1.1K5.

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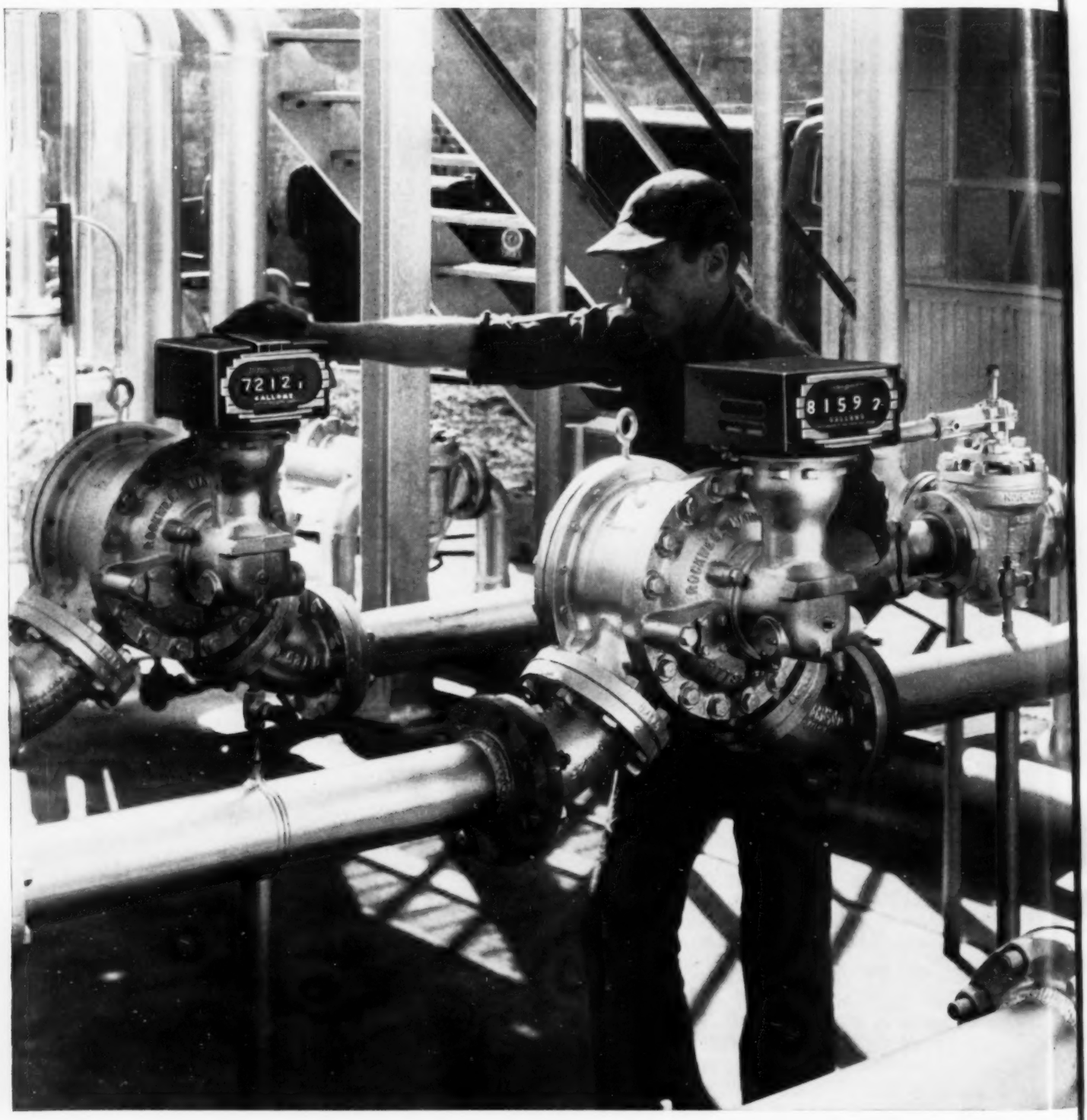

RUNNING SIMULTANEOUS ENDURANCE TESTS ON ROCKWELL ROTOCYLE METERS

Here two model 5-BLX Rotocycle meters installed side-by-side, are running competitively on a "round the clock" endurance test. New materials and design improvements are thus pre-tested and over-all meter performance can be chartered before production is ever started.

Meters

To Benefit You!

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we subject meters to every conceivable operating task, torture and abuse them to pre-prove accuracy and durability.

Here's Why!

Rockwell meter users benefit in many ways from our exacting testing procedures. For example, we know and you know *for sure* that the meters you order will precisely measure the liquids specified—will withstand shock-loads, temperatures and all the other variables normally encountered in field service.

These tests also guide us in our extensive program of research and development. Planning ahead, searching for better meter designs and improved components is a never-ending process at Rockwell. It's all part of a carefully conceived program designed to either enhance the performance or add to the value that you, our customers, receive from Rockwell products.

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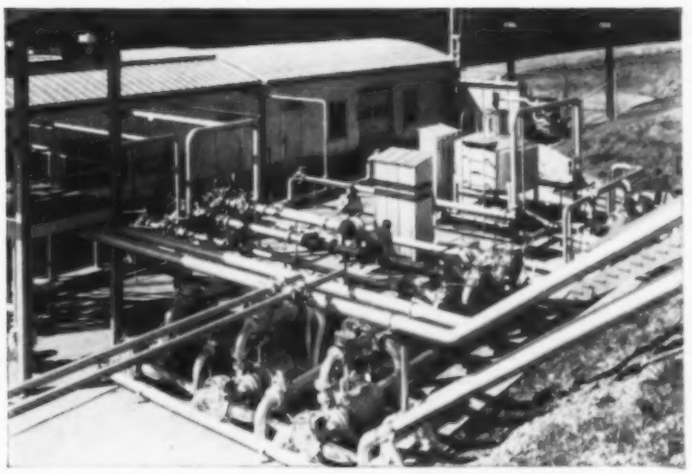
WORLD'S LARGEST METER TEST STATION. Aerial view of Rockwell testing station having every facility for petroleum meter proving, accounting, research and development.



AREA OF ACCURACY. View of operating area from storage tank level. In foreground are the three pumps which together permit testing meters at several thousand gallons per minute. Building in background houses indoor proving room, remote registration facilities and maintenance shop.

CONTROLLED ACCOUNTING. This indoor proving room is fitted with precisely calibrated tanks and weigh scales. Receiving registers for remote registration system are shown at right.

Rockwell *ROTOCYCLE* Meters

Pipe Line Men

IN THE NEWS

T. J. Kirkpatrick

Joe Tiner

Paul L. Davis

A. R. Epperson

G. J. Gillian

C. B. Amick

Ralph K. Willis

Larry E. Hanna

Panhandle Eastern Pipe Line Company has announced the creation of a new department in the Gathering area and the appointment of two new department heads in the Kansas City office. The geological section of the Land and Lease department has become the Geological department with **J. K. Curry** heading the department and superintending all geological and geophysical activities. **T. J. Kirkpatrick** was named superintendent of measurement, replacing **F. C. Walters,** who is on leave. Other appointments include **Joe Tiner** named to assistant superintendent of Measurement; **R. S. Heusel,** measurement engineer, operations; and **T. F. McEntire,** measurement engineer in charge of chart calculation and office procedure. **Paul L. Davis** has been named superintendent of the Land department and **A. R. Epperson** is assistant superintendent of Land. **H. W. Pope,** former head of the Land department, remains with the company as a consultant and will assist Davis on matters affecting the department's activities.

Compressor department changes include **G. J. Gillian,** who was transferred to the Kansas City office as assistant compressor superintendent; **C. B. Amick,** who takes over Gillian's former duties as Eastern division compressor superintendent; and **Ralph K. Willis,** named plant superintendent of the new Howell, Mich., compressor station. **Larry E. Hanna** was appointed assistant chief engineer in the Engineering department.

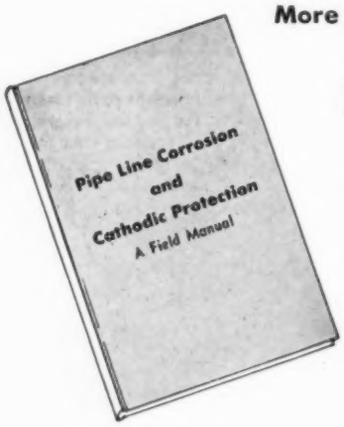
•

Joseph Bowes has been elected chairman of the board of directors and **H. A. Eddins** named president of **Oklahoma Natural Gas Company. A. E. Bradshaw,** who had been board chairman since 1933, remains as a director and a member of the executive committee.

Bowes, who had been president of the company since 1933, is a member of the board of directors of the Independent Natural Gas Association, was formerly president of INGAA and was one of the original incorporators of the association. Eddins, executive vice president of Oklahoma Natural since 1954, joined that company after serving as assistant to the president of Laclede Gas Company in St. Louis.

More comments on this new Handbook:

"... a most practical on-the-job manual for men concerned with pipe line corrosion. We are ordering copies for each of our district engineers."



Pipe Line Corrosion and Cathodic Protection

By MARSHALL E. PARKER

This Handbook, written by Marshall E. Parker, consultant, is designed as a practical field manual. It is a 108-page pocket-size volume printed first as a popular series in WORLD OIL. The Handbook is illustrated with many charts and drawings and is completely indexed by subjects.

It presents comprehensive data on Soil Resistivity Surveys, Potential Surveys, Line Currents, Current Requirements, Rectifier Systems, Ground Bed Design, Magnesium Anodes, Stray Current Electrolysis, Interference in Protective Systems, Operations and Maintenance, and Coating Protection and Testing.

An appendix has been added of technical data on Underground Corrosion, Basic Principles of Cathodic Protection, Properties of Metals and Attenuation Equations. Order copies of this practical Field Manual now for each of your field men. Price $3.

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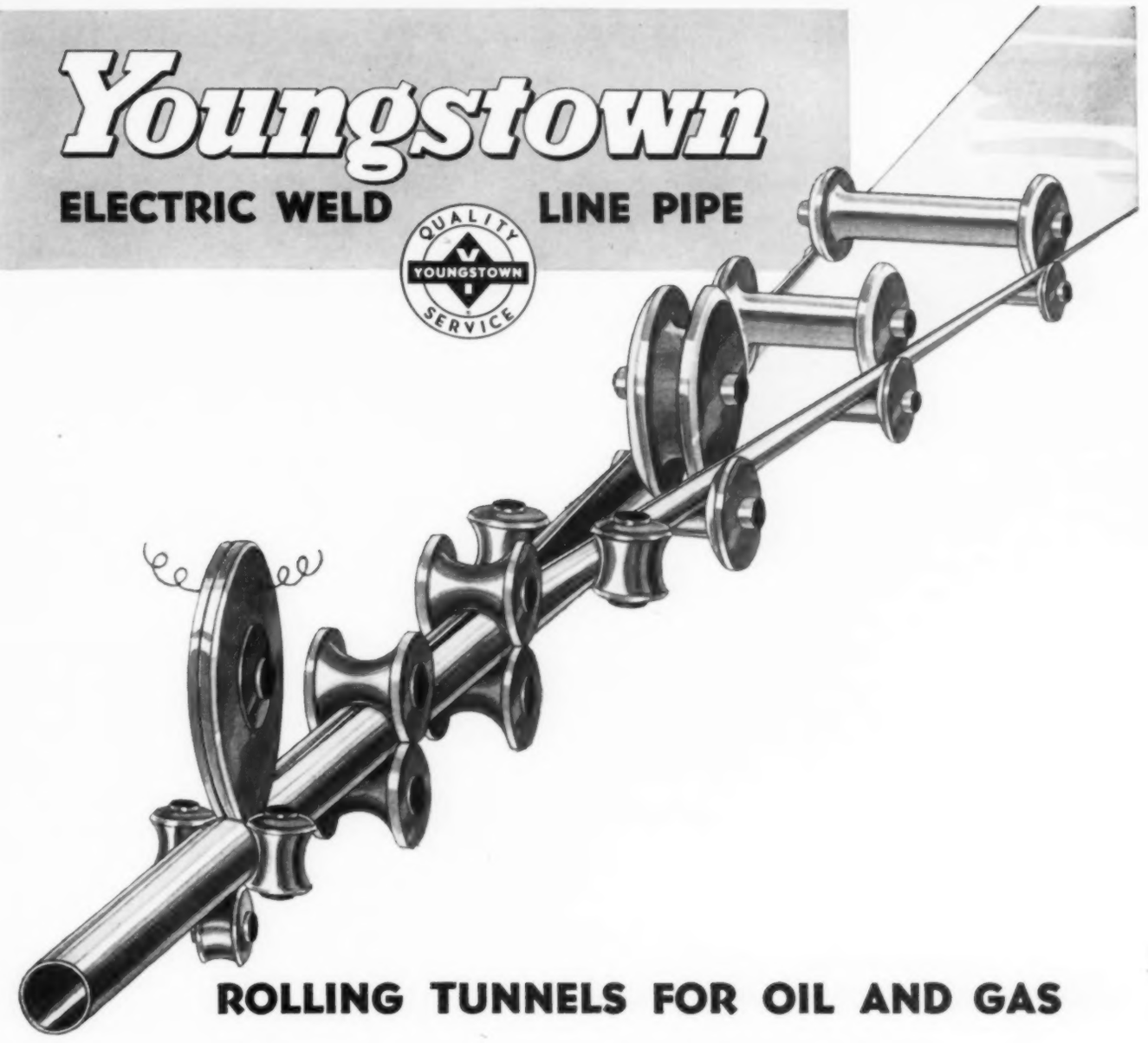
QUALITY YOUNGSTOWN SERVICE



ROLLING TUNNELS FOR OIL AND GAS

Thousands of miles of Youngstown Electric Weld Line Pipe are now serving as tunnels for oil and gas. Synchronized sets of forming rolls shape the steel skelp into tubular form. The completed tube passes from the final forming roll through the electric welder which joins the edges in a solid continuous weld. With rigid quality control continued through the final processing operations, Youngstown Electric Weld Line Pipe is ready to become tunnels for oil and gas.

★ ★ ★

Four reasons why Youngstown Electric Weld Line Pipe is your best buy: (1) It bends readily; (2) Wall thickness is uniform; (3) Weldability is outstanding; (4) Long lengths save you time and trouble. The Youngstown Sheet and Tube Company, Youngstown 1, Ohio. Sales and service offices throughout the oil and gas producing areas.

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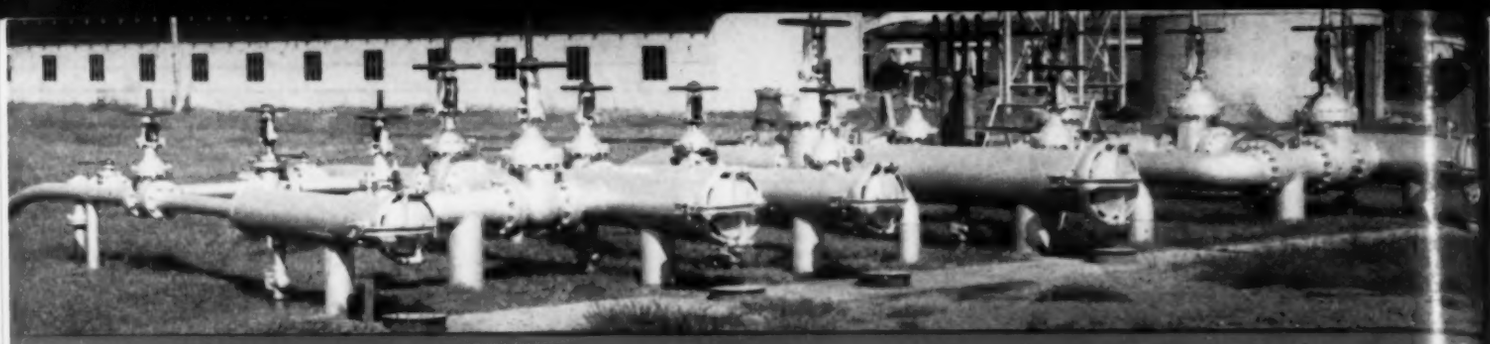
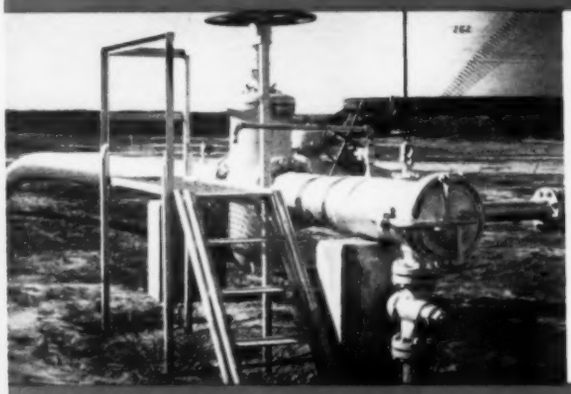
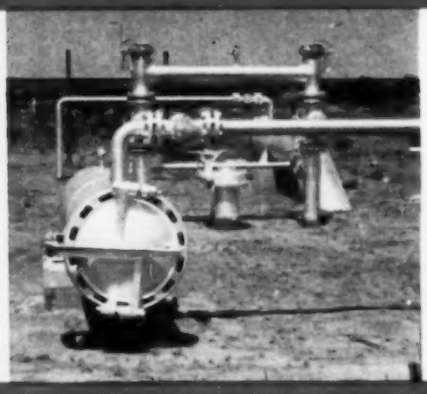
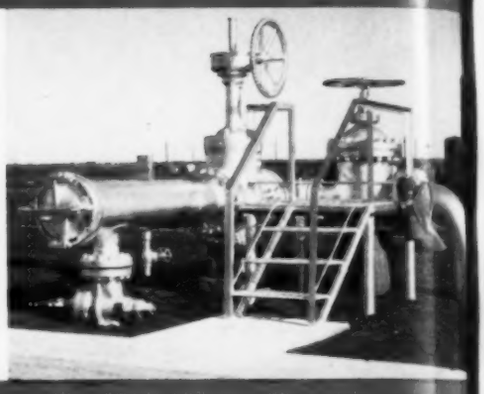
For more data on advertised products, use Readers' Service Cards, last page.



The handiest, safest way to







start and catch a pig....

Unibolt Hinged Scraper Traps

All you need do to open the UNIBOLT Hinged Scraper Trap is release two bolts and the blanking plug swings open like a door. No heavy lifting. Nothing to fall on workmen. No time-consuming blind flanges to make up. No danger of leaks—the UNIBOLT self-sealing oil-resistant gasket, which seldom needs replacement, assures a pressure-tight seal and low maintenance.

Many operators fabricate UNIBOLT Hinged Scraper Trap closures on an oversize barrel in order to facilitate starting the pig. Thus, line pressure does the heavy work.

Wherever multi-bolt flanged couplings and closures are now being used . . . on strainers, scrubbers, mist removers, terminal manifolds, blowdowns or other pressure vessels . . . UNIBOLT Couplings will serve you better.

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C. C. Bledsoe

Earl Allen

John H. Williams

Kenneth A. Owen

C. C. Bledsoe, vice president and treasurer of Midwestern Constructors, Inc., Tulsa, was elected president of the **Pipe Line Contractors Association** at its annual meeting at Boca Raton, Fla. Bledsoe succeeds **H. C. Price** of Bartlesville. **Earl Allen,** Associated Pipe Line Contractors Inc., Houston, was elected first vice president, and **John H. Williams,** Williams Bros. Co., Tulsa, was elected second vice president. **Kenneth A. Owen,** Parkhill Truck Company, Tulsa, was named treasurer. Directors whose terms will expire at the close of the next convention are **Allen, R. A. Coynes, G. A. Manuel, Bledsoe, R. P. Gregory,** and **Price.** Newly-elected directors, serving until 1958, are **Jack S. Gray, Owen, Williams, James P. Neill, Robert D. Sheehan,** and **Maurice S. Williams.**

•

Harry B. Copeland has been named to the newly-created position of superintendent of the crude oil lines in the Martinsville (Ill.) Pipe Line division of **The Ohio Oil Company.** Formerly assistant superintendent in the Pipe Line Communications department, Copeland started with Ohio Oil in 1920 as a lineman in a construction gang and was appointed foreman. Later he worked on construction projects in the Communications department near Findlay, Ohio, and transferred to Martinsville in 1926. Since 1951 Copeland has been assistant superintendent of pipe line communications.

Southern California Gas Company has announced the retirement of **Harry L. Masser,** executive vice president, after nearly 40 years of service. **R. I. Snyder** has been elected vice president. Snyder, formerly manager of the Distribution department for the utility, was named assistant vice president last September to serve as a general assistant to Masser. He will direct customer service and distribution department activities.

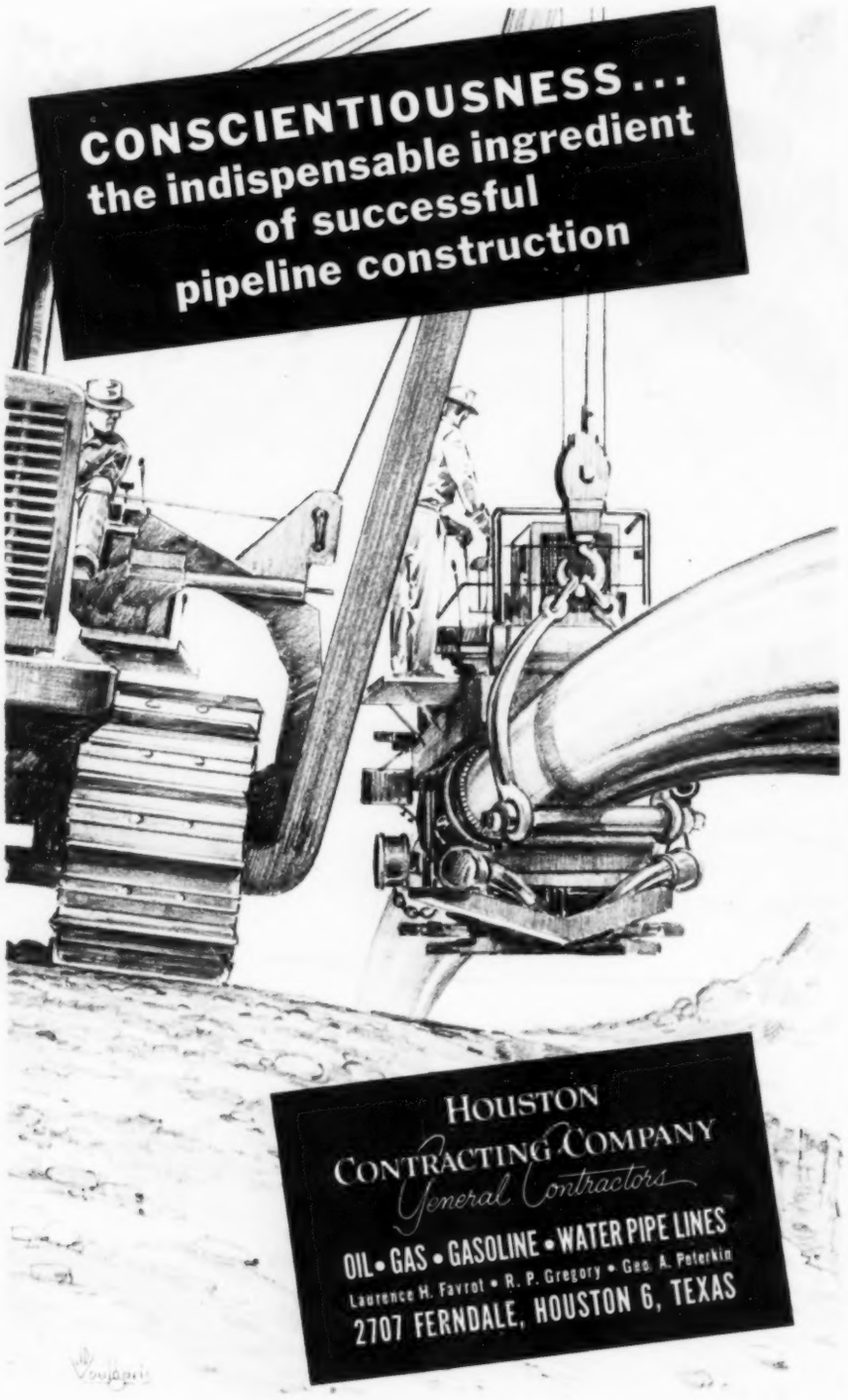
Masser served as president of the Pacific Coast Gas Association. He first joined Southern California Gas Company in 1915, leaving for military service and later a position with the Railroad Commission. He returned to the gas business in 1924 as gas engineer for the Los Angeles Gas and Electric Corporation, becoming vice president and director in 1928 and assistant general manager in 1932. Masser was named executive vice president in 1937 when Los Angeles Gas and Electric merged with Southern California Gas.

For more data on advertised products, use Readers' Service Cards, last page.

Ralph E. Hruska

Donald C. Thomas

Ralph E. Hruska has been elected secretary of **Service Pipe Line Company** succeeding **W. O. Middaugh,** who resigned. **Donald C. Thomas,** assistant, manager of Service Pipe Line Company's Procedure department, was elected assistant secretary. Other officers who were reelected are **J. L. Burke,** president; **J. L. Shoemaker,** financial vice president; **J. R. Polston,** vice president—operations; **R. J. Andress,** executive vice president; **J. R. Fredenberger,** treasurer; **C. W. Keith,** comptroller; **W. E. Taylor,** assistant treasurer; and **J. L. Donovan,** assistant comptroller.



O. Q. Lomax, president of **Humble Pipe Line Company,** has been elected chairman of the Committee for Pipe Line Companies, an association representing 67 interstate and intrastate pipe line carriers of crude oil and products. Lomax joined Humble Oil & Refining Company in 1918. He served in various capacities until 1942 when he was elected to the Humble Pipe Line Company board of directors and made vice president and general superintendent. Lomax has been president since 1950.

O. Q. Lomax

•

Forrest W. Lewis, Jr. of Owensboro has been appointed manager of the newly-created Gas Storage department of **Texas Gas Transmission Corporation.** Lewis will direct the development and operation of the company's program of underground storage of natural gas. Lewis formerly was a senior engineer in the Measurement and Research department.

•

Northern Natural Gas Company has announced the appointment of **R. Dean Grimm** of Bartlesville, Okla., to the newly-created position of manager of gas reserves and availability in Northern's Gas Supply department. Grimm has more than 18 years experience in the natural gas industry. He has been assistant manager of the Gas Reservoir department of Phillips Petroleum Company.

R. Dean Grimm

•

John H. Osborne has been appointed chief dispatcher, Eastern Products division of **The Buckeye Pipe Line Company,** with headquarters at Macungie, Penn. He succeeds the late **Boyd Ozment.** Osborne joined Buckeye in 1952 as a scheduling dispatcher, after 12 years service with The Atlantic Refining Company and Keystone Pipe Line Company in Philadelphia.

MAINSTAYS of PRODUCTION

wherever the spread runs!

In terrain like this, east of Plevna, Montana, production averaged three miles a day. O. R. Burden Construction Corp., Tulsa, Oklahoma, used an equipment line-up that was predominantly Caterpillar for money-making performance.

Along with these two CAT* MD6 Pipelayers on this spread east of Plevna, Montana, the O. R. Burden Construction Corp. relied heavily on other Caterpillar equipment for profitable production. Included in its line-up here were the following big yellow units: three D8 Tractors, four D7 Tractors, one MD7 Pipelayer, two D13000 Engines in Cleveland ditchers and a No. 12 Motor Grader.

You'll find that concentrating on Caterpillar equipment pays off *three* ways:

1 Every unit, from pipelayer to motor grader, is ruggedly constructed to stand up under the beating of pipeline construction. The MD6, for instance, has an exclusive oil-type clutch that seldom requires adjustment and lasts much longer than ordinary clutches. And its bellows sealed track rollers keep mud and dust out for longer life. These, and other Caterpillar-developed features, enable it to do *more* work at *lower* cost with *less* down time on any job.

2 Familiarity with Caterpillar's simply designed engines enables your mechanics and grease crews to handle maintenance routine with a minimum of time.

3 The network of Caterpillar Dealers makes it easy for you to handle your replacement parts problems wherever you are. Here's word from Burden's Spread Superintendent C. M. Hoffman about this: "Wherever our spread runs, we find Caterpillar Dealer service ready and willing to keep our Cat equipment in top operating condition."

What's more, you'll find the latest developments in pipeline equipment *first* at your Caterpillar Dealer. One example: the all-new 190 HP No. 583 Pipelayer —the first complete pipelaying unit, with a lifting capacity of 130,000 pounds maximum. For complete information on the rugged yellow line, see him today.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

USE CAT EQUIPMENT FOR MONEY-MAKING PRODUCTION

Walter C. Roberts, manager of **Shell Oil Company's** pipe line operations on the West Coast, has retired after 40 years in the pipe line industry. Roberts joined Shell as a dispatcher at the Coral Pump Station office near Tracy, Calif. Roberts became chief dispatcher for Shell's California pipe lines in 1923 and transferred to the area's exploration and production headquarters, being named department manager in 1946.

Walter C. Roberts

•

Ralph Troseth, assistant general manager of **Texas-New Mexico Pipe Line Company,** has been granted a leave of absence to accept assignment with the U. S. Department of State on its international staff in Paris, France. During his absence **F. B. Whitaker, Jr.,** division manager, will be in charge of the company's Midland office.

Robert L. Bowman

W. T. Thagard

Robert L. Bowman, manager of construction for **Bechtel Corporation's** pipe line division, has been elected a vice president of the affiliated Bechtel International Corporation. Bowman joined Bechtel Corporation in 1940 and has supervised the construction of some of the firm's major pipe line projects. Included among these are the Trans-Arabian pipe line across Saudi Arabia in 1947-49, the Pacific Gas and Electric Company's gas line from Topock to Milpitas, Calif., in 1949-51, and the Lakehead line across the straits of Mackinac in 1953-54. In 1954 he was named manager of construction and recently has been in charge of construction of the Tennessee Gas Transmission Company pipe line project in Pennsylvania, New Jersey and New York.

•

W. T. Thagard III has been appointed director of plans and economic research for **Texas Eastern Transmission Corporation.** Thagard joined Texas Eastern in 1947 as administrative engineer after working for Ebasco Services Inc. and the Atlanta Gas Light Company. During World War II Thagard served with the U. S. Army in Europe with special assignment as utilities advisor for the rehabilitation of gas and electrical utilities in France, Belgium, the Netherlands and Germany.

•

United Gas Corporation has announced the advancement of four Shreveport men. **W. V. Cousins** and **C. C. Barnett** were elected vice presidents of the firm's subsidiary, **United Gas Pipe Line Company. D. D. Dillingham** was appointed assistant to **Ed Parkes,** recently elected vice president and general manager of United Gas Corporation and its subsidiaries, and **V. S. Brennan** was named personnel director of the companies.

Question to management...

What is the real worth of Cathodic Protection?

The real worth of cathodic protection depends primarily upon its effectiveness after it is installed. Inadequately designed or improperly installed systems will not do the job. Savings on your corrosion control costs can best be obtained with experienced E. R. P. corrosion engineers working with your staff.

Successful cathodic protection requires careful investigation and correct interpretation of all factors affecting the corrosion of any buried or submerged structure. When you use Electro Rust-Proofing cathodic protection services, you are assured of a successful installation, for E. R. P. brings to each job a background of 20 years experience in survey, design and installation of cathodic protection systems.

Your inquiry—written now—will bring our engineers to discuss your corrosion control program—without obligation.

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E-31

REMOTE FUNCTION CONTROL ADDED TO

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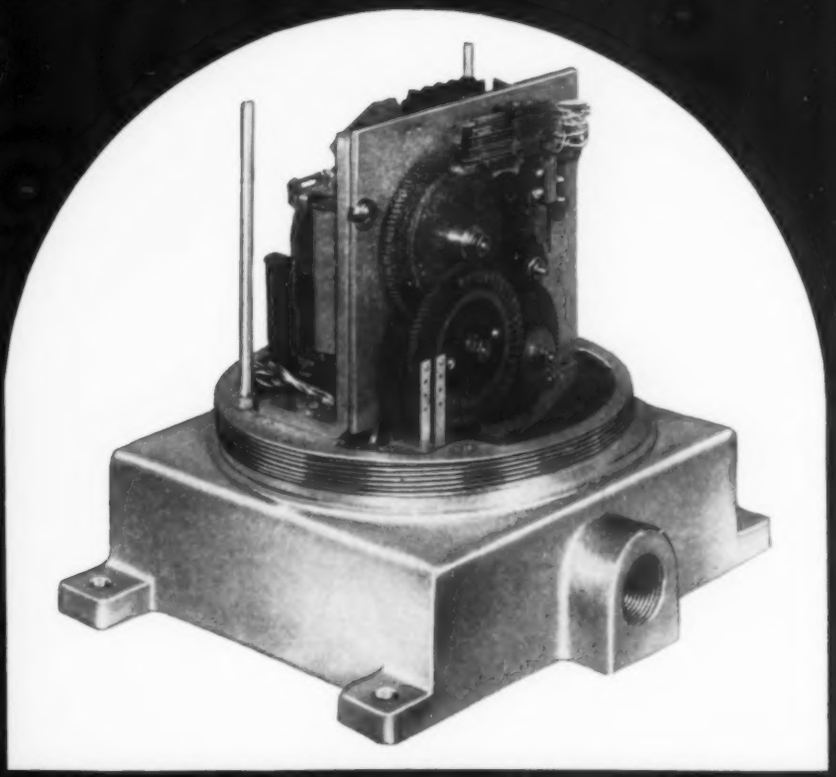
Telepulse



WHAT IS IT?

An electronic device for controlling remote functions such as motorized valves, starting or stopping of motors, pumps, compressors, etc. Can be used between any points where communications facilities reach, whether by private or leased wires, carrier or Microwave. As easily installed as another Telepulse Gaging Transmitter.

HOW DOES IT WORK?

The operator selects the position which controls a remote function, presses the button, the station selected responds with a signal confirming proper selection, then indicates its present condition. If the operator wishes to change that condition from open to closed, or from closed to open, pressing a button does the job, no matter how far distant the remote function is from the operator. After this change, the Remote Function Control automatically sends back to the operator a confirming signal indicating that the indicated change has taken place.

CAN YOU USE IT?

Very easily if you now have an S. & J. Telepulse System of Automatic Remote Tank Gaging. The Remote Function Control will enlarge its field of service. You may anticipate a further expansion of the field of usefulness of the S. & J. TELEPULSE.

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REPRESENTATIVES:
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MONTREAL: Lytle Engineering Specialties, Ltd., 360 Notre Dame St., W.
TORONTO: Lytle Engineering Specialties, Ltd., 69 Eglinton East
VANCOUVER: P. D. McLaren & Son, Ltd., 3277 Main Street
CALGARY: P. D. McLaren & Son, Ltd., 510 - 9th Ave. W.
MEXICO, D.F.: Dalmar Comercial S. A.
CARACAS: Sinclair Spence, C.A., Edificio Galipan
ENGLAND: Whessoe, Ltd., Sales: 25 Victoria St., London S. W. 1
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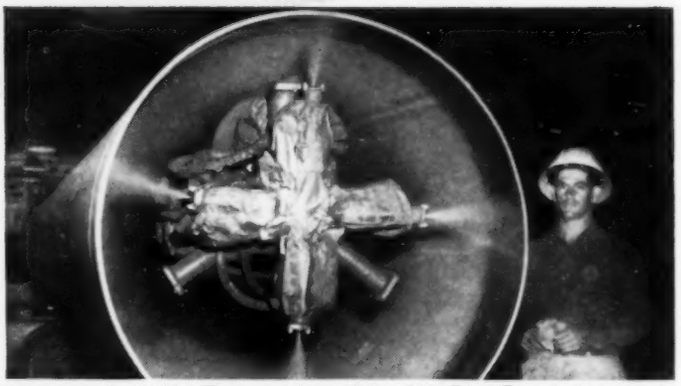
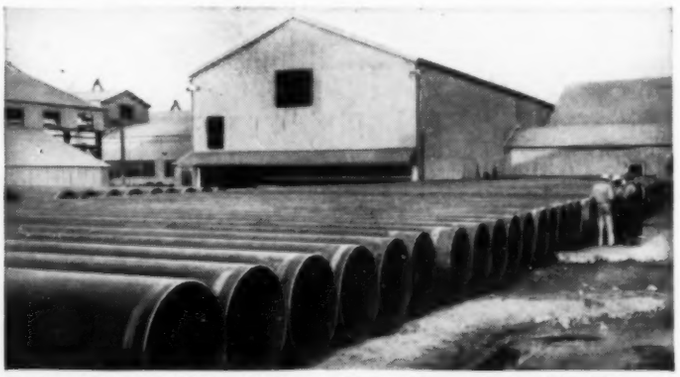
EPON® RESIN does it!

New Internal Coating *protects pipelines against corrosion by crude oil, salt water, gas*



36" pipe to be laid by Transcontinental Gas Pipe Line Corp. being coated with *Copon*, containing Epon resin. *Copon* is manufactured by Coast Paint and Lacquer Co., Houston.



Stock of 36" pipe, lined with Epon resin coating, to be used by Transco.

HERE'S HOW...

INTERNAL CORROSION of gas pipe lines has long been a costly maintenance problem. The solution is an Epon resin coating that stands up to corrosives, that does not flake or peel off, that can be readily applied.

Such an Epon resin-based enamel is now going to work in nearly 300 miles of line for Transcontinental Gas Pipe Line Corp.

It's a *one-coat*, amine-catalyzed system which, cured at atmospheric temperatures, gives the performance of many baked finishes never before obtained with any other cold-cure coating. The Epon resin liner has complete adhesion to metals and extreme resistance to corrosion that keeps gas free of rust and pipe scale.

If you need a paint that lasts longer, that has excellent adhesion, resistance to abrasion and impact, ability to withstand a wide range of temperatures, humidity and corrosive atmospheres . . . ask for *Epon resin coatings*. Call on our sales offices for names of suppliers. Write for the full Epon coatings story in the brochure, "Planning to Paint a Pyramid?"

Epon resins are the epoxy polymers made exclusively by Shell Chemical Corporation.

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IN CANADA
Chemical Division, Shell Oil Company of Canada, Limited
Toronto • Montreal • Vancouver

Harrison B. Haney, vice president of **Tide Water Associated Oil Company,** has been appointed manager of transportation of the company. Haney is responsible for planning and coordination of all company transportation activities including marine and pipe line operations. Haney joined Associated Oil Company, a predecessor of Tide Water, in 1917, serving as chief engineer from 1929 to 1936. In 1936 he was appointed manager of western division transportation of Tide Water Associated Oil Company and in 1949 was elected to a vice presidency.

Harrison B. Haney

•

Ralph O. Dietler, formerly chairman of the board of Stanolind Oil Purchasing Company, announces the opening of an office for oil and gas consulting, financing, and investments in the Stanolind building, Tulsa.

•

George H. Supple has been appointed director of transportation for **General Petroleum Corporation.** Prior to this appointment, Supple, a vice president of General Petroleum, had been director of pipe lines.

•

P. N. Johnson has been appointed president of **Salt Lake Refining Company** and **Salt Lake Pipe Line Company.** Johnson, who has been on special assignment with Standard's Manufacturing department for the past several months, takes over the presidency of the Standard subsidiaries from **J. T. Higgins,** who is being advanced to assistant general manager of the Manufacturing department. Johnson has been with the Standard organization since 1939. Prior to his last assignment, he was a superintendent at the company's El Segundo, Calif., refinery.

P. N. Johnson

S. A. Hallberg, Twin Cities division superintendent at Minneapolis and St. Paul, Minn., in the Supply and Transportation department of **Standard Oil Company (Indiana),** has been named Chicago division superintendent pro-tem, relieving **R. T. Scott,** who is convalescing. **N. F. Tietze,** district superintendent at Spring Valley, Minn., succeeds Hallberg and **C. G. Weibel,** Twin Cities division engineer, replaces Tietze as district superintendent at Spring Valley. **C. W. Bergstrom** of the products pipe line engineering division at the company's general office at Chicago succeeds Weibel.

Other changes in the Supply and Transportation department include the promotion of **S. L. Jackson** to manager of transportation and **W. A. Bennett** to manager of distribution. **R. B. Rodgers** will be general superintendent of distribution planning; **J. R. Olson** is appointed superintendent—distribution planning; **D. V. Hartzell** is general superintendent of terminals; and **F. M. Palmer** and **R. M. Shearer** become assistant general superintendents of terminals.

Another New
WmSON - HILLCO
TAPPING MACHINE
MODEL
360
EASY ACTION CLUTCH*
AUTOMATIC CUTTING FEED
HEAVY DUTY BEARINGS*
HAND POWERED OR WITH AIR MOTOR DRIVE
REFINERIES • STEEL MILLS
PIPELINES • CHEMICAL PLANTS
For making high pressure, high temperature taps into piping and tanks WITHOUT SHUTDOWN
• 24" BORING BAR TRAVEL PERMITS . . .
PIPE TAPS TO 6"
TANK TAPS TO 6"
MAXIMUM OPERATING PRESSURE
1,440 PSI AT 100° F.
MAXIMUM TEMPERATURE
700° AT 700 PSI
EACH MACHINE TESTED TO: 2,175 PSI
SELF ADJUSTED CHEVRON PACKING*
INTEGRAL FLANGE FORGING*
ASA — 600# RTJ FLANGE
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*NEW FEATURES FOUND ONLY IN 360 MACHINE WHICH SUPERSEDES MODEL 300
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the design that gives you

. . . more power . . . with less fuel . . . over longer periods between overhauls

Powerful, efficient performance . . . reduced fuel costs . . . minimum down-time. That's what you can expect from your diesel or gas engines with Pedrick *conformable* oil rings.

The Pedrick DO8 design makes this possible: two separate cast-iron pieces, thin and flexible, provide independent cylinder contacting surfaces. These are kept under absolutely uniform tension by the exclusive Pedrick "Equalizer". This feature provides a soft but positive and uniform pressure *all around the cylinder wall*, with both radial and axial conformability. With the DO8 you get the effect of *two* very conformable oil rings in one groove.

The result is more effective oil control with less unit pressure and ring friction. Wear is reduced. Overhaul periods are extended. Oil control stays constant for tens of thousands of hours. Carbon pollution is all but eliminated.

Whether your requirements are single rings or engineered sets, it will pay you to insist on Pedrick. Engineering service is available to help you with special problems.

Write, phone or wire: WILKENING MANUFACTURING CO., Philadelphia 42, Pa. SAratoga 9-3770. In Canada: Wilkening Manufacturing Co. (Canada) Ltd., Toronto 2.

PEDRICK PIONEERED CONFORMABLE OIL RINGS

Pedrick PISTON RINGS

Louis M. Miller, assistant chief engineer for **Sun Pipe Line Company,** has been appointed treasurer to succeed the late **Russell W. Bowers.** Miller also becomes treasurer of Sun Oil Line Company of Michigan and Sun Pipe Line Company of Illinois as well as assistant treasurer of Sun-Canadian Pipe Line Company, Limited. He will be manager of operations for the Product Lines department of Sun Pipe Line. Miller began his association with the petroleum industry in 1919.

•

George A. Whitten has been appointed assistant to the manager and in charge of construction and maintenance of **Texas Gas Corporation. Jesse Bertrand** has been named superintendent of operations and **Donald G. Hall** appointed field foreman in the operations section of the Winnie area. **Ed Shettle** and **Clovis Bernard, Jr.** are manager and chief engineer of the Pipe Line department.

WHO'S MEETING WHERE

SGA Distribution Management Conference, Jung Hotel, New Orleans, March 1-2.

SGA Transmission Management Conference, Jung Hotel, New Orleans, March 1-2.

Annual Gas Processing Conference, University of Oklahoma, Norman, March 6-7.

National Association of Corrosion Engineers, Hotel Statler, New York, March 12-16.

Mid-West Gas Association, Hotel Fontenelle, Omaha, Neb., March 19-21.

New England Gas Association, Annual Meeting, Hotel Statler, Boston, March 22-23.

National Oil and Uranium Exposition, 48th District Agricultural Association Building, Los Angeles, April 1-8.

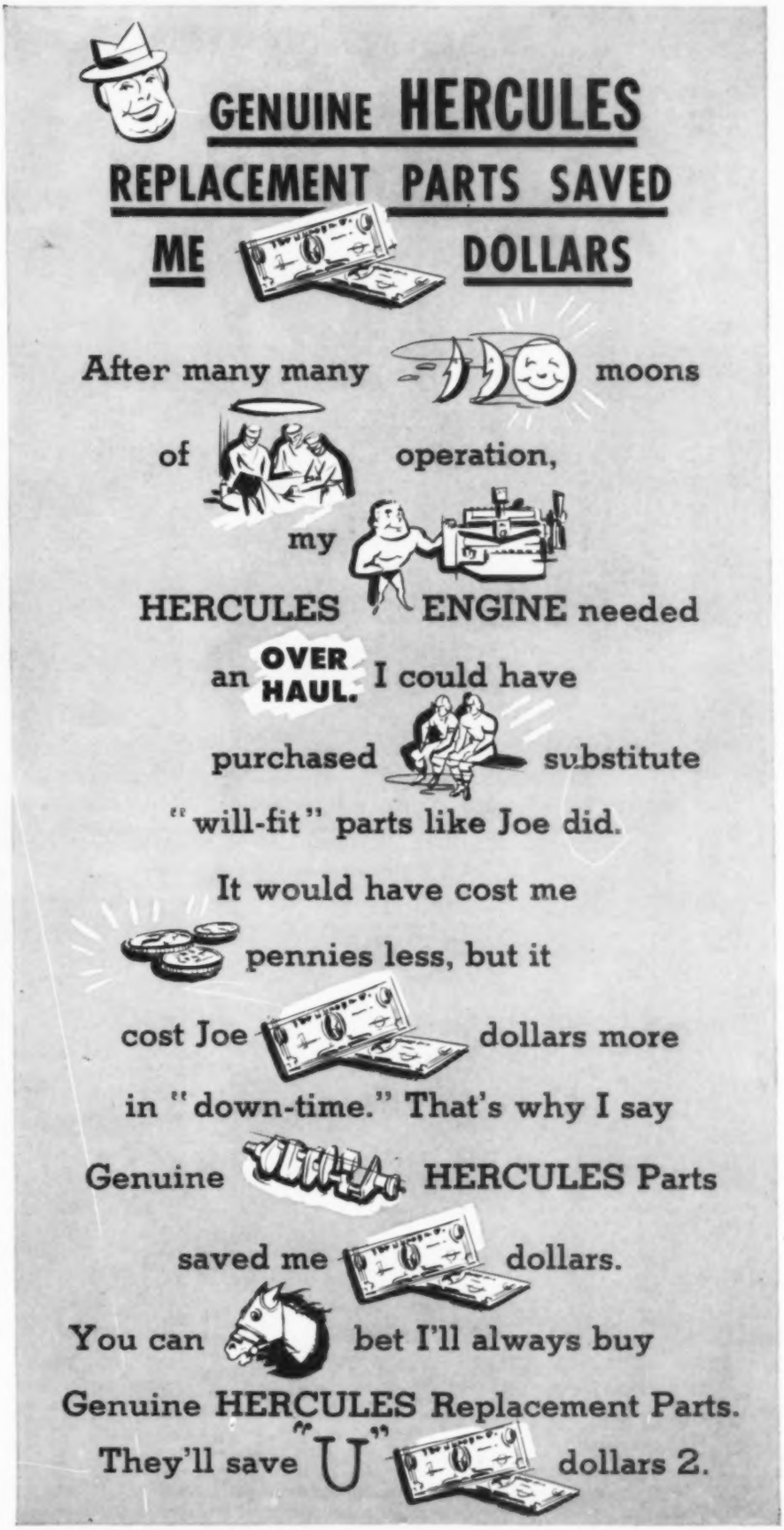
AGA Research and Utilization Conference, Cleveland, Ohio, April 3-4.

Corrosion Control Short Course, The University of Oklahoma, Norman, April 3-5.

Ninth Oil Recovery Conference, A Symposium on Natural Gas in Texas, Texas Petroleum Research Committee, Texas Memorial Student Center, Texas A. & M. College, College Station, April 9-10.

Southern Gas Association, Conference on Use of Electronic Computers by Engineering Personnel, Hilton Hotel, El Paso, April 14-15.

Petroleum Equipment Suppliers Association, Annual Meeting, Boca Raton, Fla., April 14-18.

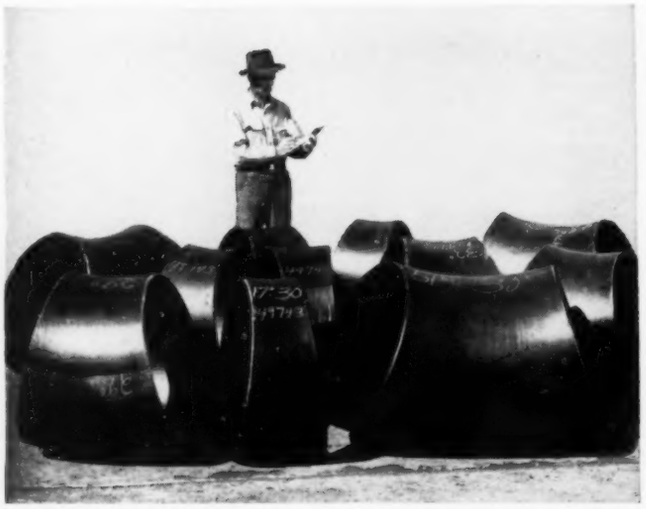


For more data on advertised products, use Readers' Service Cards, last page.

Speed up the job with

TUBE-TURN®

welding fittings and flanges



ANY ANGLE! Tube Turns can supply you with pipe line elbows not only in 45° and 90° types but in odd angles . . sizes as large as 42". Specify TUBE-TURN* Welding Fittings and save valuable time in the field.

COST REDUCERS. On Transcontinental line, TUBE-TURN Venturi Reducers minimize cost of valves and scraper traps. Reducers shown are 36" x 30" Courtesy Transcontinental Gas Pipe Line Corporation.

SIMPLIFIES CONSTRUCTION. You can get TUBE-TURN Manifold Welding Fittings with size, wall thickness and number of outlets as required by your job. Reduces costs for many types of service. Easy to install.

FOR "HOT TAPS." Strong, safe "hot tap" connections are made possible by the TUBE-TURN Full Encirclement Saddle. Fully meets all requirements for reinforcement of welded branch connections.

*"TUBE-TURN" and "tt" Reg. U.S. Pat. Off.

TUBE-TURN Welding Fittings and Flanges are made in U.S.A.
They meet all U.S. piping code specifications

TUBE TURNS LOUISVILLE 1, KENTUCKY

A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Cleveland • Detroit • Chicago • Kansas City • Denver
Los Angeles • San Francisco • Seattle • Atlanta • Tulsa • Houston • Dallas • Midland, Texas

Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, April 17-19.

Conference on Marine Corrosion and Fouling Problems, University of California Engineering Extension, La Jolla Campus, April 18-20.

Indiana Gas Association, French Lick Springs Hotel, French Lick, Ind., April 19-20.

Southern Gas Association, Annual Convention, Dallas, April 23-25.

Pacific Coast Gas Association, Gas Supply and Transmission, Technical Section, Las Vegas, Nevada, April 24-25.

API Safety and Fire Protection Midyear Meeting, Warwick Hotel, Philadelphia, April 30-May 4.

LPG Association Convention and Show, Conrad Hilton, Chicago, May 6-9.

AGA Distribution, Motor Vehicles and Corrosion Conference, Congress Hotel, Chicago, May 7-10.

AGA Gas Supply, Transmission and Storage Conference, Conrad Hilton Hotel, Chicago, May 10-11.

API Division of Transportation, Shamrock-Hilton, Houston, May 13-16.

AGA Chemical Engineering and Manufactured Gas Production Conference, Benjamin Franklin Hotel, Philadelphia, May 16-18.

Pennsylvania Gas Association, Pocono Manor Inn, Pocono Manor, Penn., May 22-24.

Natural Gas & Petroleum Association of Canada, Sheraton Brock Hotel, Niagara Falls, Ont., Canada, May 24-25.

Eleventh Annual Short Course in Gas Technology, Texas College of Arts and Sciences, Kingsville, Texas, May 30-June 1.

Canadian Gas Association, Manoir Richelieu, Murray Bay, Quebec, June 24-27.

Michigan Gas Association, Grand Hotel, Mackinac Island, Mich., June 25-26.

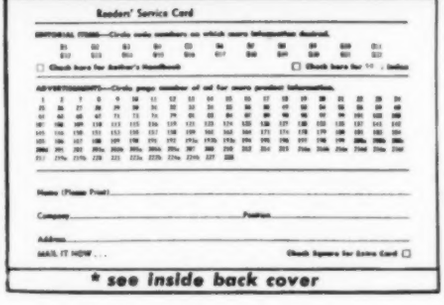
Pacific Coast Gas Association, Annual Meeting, Coronado, Calif., Sept. 11-13.

International Gas Union, Sixth Annual Conference, Hotel New Yorker, New York City, Sept. 25-30.

AGA Annual Meeting, Atlantic City, N. J., Oct. 15-17.

Rocky Mountain Oil & Gas Association, Annual Convention, Cosmopolitan Hotel, Denver, Oct. 22-24.

use these
READERS' SERVICE CARDS*
for more information

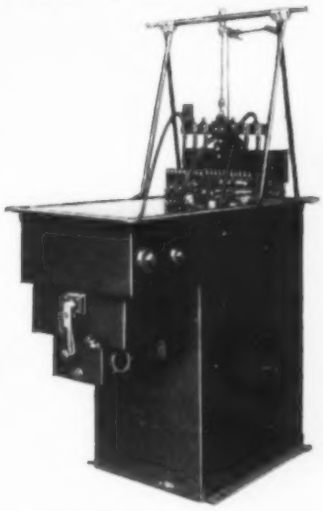

Readers' Service Card

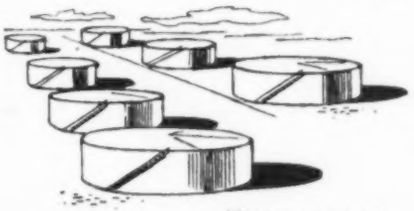
* see inside back cover

BUILT TO THE REQUIREMENTS OF OIL MEN

EC&M

TOTALLY OIL IMMERSED 50,000 KVA interrupting capacity MOTOR STARTERS *have many advantages*





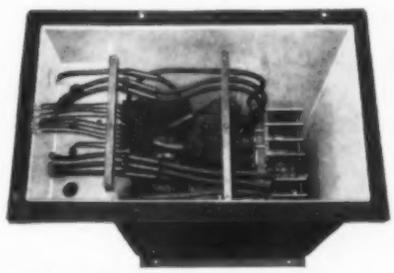
These starters are designed specifically for Division 2, semi-hazardous locations. They are low in first cost and are easy to service when inspection or maintenance are necessary. They require little floor space.

High interrupting capacity is inherent . . . 50,000 KVA and no power fuses required. The well-known Type ZHS Magnetic Contactor has been certified for this rating. It is of heavy-duty construction to assure trouble-free operation.

Before buying 2300-5000 volt motor starters, investigate EC&M Type ZHS Starters. They provide economy in installation, operation and maintenance, and are available in a range of horsepower sizes.

Write for Bulletin 1062-20.

Contactor and Relay Panel are bolted together for raising as a unit above the oil. No leads or bolts to disconnect. Shown is Cat. No. 2645A Lifting Mechanism, available at small cost.



Looking down into starter showing anti-syphon lead construction from contactor, control transformer and overload relay panel to conduit connection box with threaded couplings. Starter with oil disconnect switch shown in views above.

THE ELECTRIC CONTROLLER & MFG. CO.
Division of Square D Company
4498 LEE ROAD • CLEVELAND 28, OHIO

What's Happening

AMONG SERVICE AND SUPPLY MEN

O. E. Thompson

R. R. Hughes

E. C. Robinet

R. M. Riddell

T. D. Williamson Appoints Representatives, Sales Manager

T. D. Williamson, Inc. has announced the appointment of O. E. (Neal) Thompson to assistant sales manager. Thompson joined the company in 1948, having previously worked on a government project. Neal attended Bucknell University and now resides in Tulsa.

Assisting him will be Kenneth Hulse and John Montgomery, both of whom have been associated with the Sales department for several years.

The firm also has announced the appointment of R. R. Hughes of R. R. Hughes Company, Seattle, as representative for the Pacific Northwest, including the states of Washington, Oregon, Idaho and Montana. E. C. (Paul) Robinet of Cameron Engineering Company, Los Altos, Calif., and R. M. Riddell of R. M. Riddell Co. of Pasadena, Calif., have been named northern and southern California representatives for T. D. Williamson.

F. W. Gartner Receives License from Norton

F. W. Gartner Company of Houston has received license from the Norton Company to apply the Rokide coating. Gartner is one of the five licensees for this product in the U. S.

Rokide is a ceramic coating designed to withstand elevated temperatures, thermal shock, erosion, corrosion and oxidation.

Enterprise Engine Appoints Minneapolis District Manager

J. C. MacMillan is now Minneapolis district sales manager for Enterprise Engine & Machinery Co. The appointment was announced by Arthur W. Ostrander, general sales manager for the San Francisco firm, a division of General Metals Corporation.

MacMillan was formerly vice president of a Minneapolis consulting engineering firm, Ralph D. Thomas & Associates, Inc.

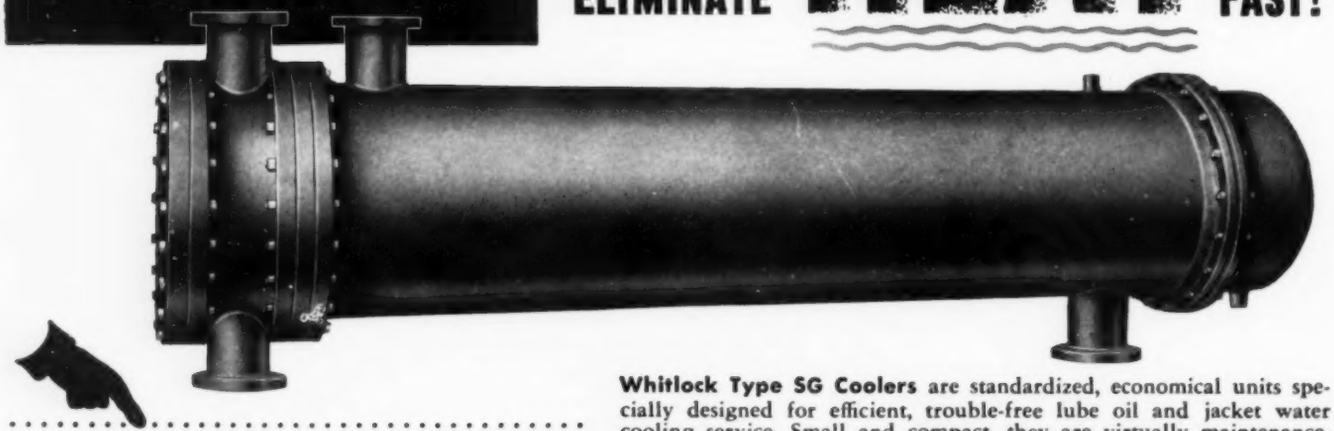
Three Companies Merge Into Nicolet Industries

Norristown Magnesia and Asbestos Company, Sall Mountain Company and Valley Forge Metals Company, all wholly owned subsidiaries of Nicolet Industries, Inc., have merged into Nicolet Industries, Inc.

They will be known as the following divisions of Nicolet Industries, Inc: Norristown Asbestos division with A. A. Lofquist as president; H. W. Donnelly, vice president; and L. D. Todd, controller; Sall Mountain division with L. L. Wilson, president; R. D. Deininger, plant manager; D. H. Ruh, sales manager; and E. F. Stephan, controller; and Valley Forge Metals division, Lofquist, president, and Mrs. W. Baylie, vice president.

PIPELINE COMPRESSOR STATIONS

ELIMINATE HEAT FAST!



Whitlock Type SG Coolers are standardized, economical units specially designed for efficient, trouble-free lube oil and jacket water cooling service. Small and compact, they are virtually maintenance-free and give dependable operation even when in continuous service, handling high heat loads. The materials of construction — non ferrous tube bundle, cast iron channel and steel pipe shell — mean long, trouble-free equipment life. The Type SG Cooler is widely used in the small standard sizes but larger units to fit individual requirements are available when required. Fill in and return the coupon today for Bulletin 122 which will give you the whole story.

THE WHITLOCK MANUFACTURING CO.
98 South Street, Hartford 10, Conn.

☐ Please send Bulletin 122 describing Whitlock Lube Oil and Jacket Water Cooler — Type SG.

Name .....

Title .....

Company .....

Address .....

WHITLOCK

Designs and Builds: bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.

Tuffy® SLING NEWS

Vol. 1 — Published Monthly in Leading American Trade Magazines by Union Wire Rope Corp. — No. 5

NEW FERRULE TEAMS UP WITH Tuffy® FABRIC FOR BETTER SLINGS

Strength of Machine Braided Fabric Equaled in Eye-Splice

SPEEDS UP SLING WORK

See for yourself at your Tuffy distributor's how this new, steel ferrule on all Tuffy Slings is streamlined with no rough edges to injure hands or catch on loads.

The new ferrule on all Tuffy 9-part machine braided wire fabric slings is the most important development in slings since Tuffy made history by introducing machine braided wire fabric. Here's why:

1. This new ferrule, squeezed around the tucked eye splice of Tuffy Slings, under pressure, creates a force of friction so powerful that a pulled out splice is virtually a thing of the past.
2. Because the ends of the ferrule are swaged flush with the machine braided strands, there are no projections left to snag on loads or injure hands. As a result, handlers can work much faster and with greater safety—doing more in a shorter time—when they're working with flexible, Tuffy Slings.

3. You pay nothing extra. The new Tuffy eye-splice with pressed on metal ferrule gives you a far better Tuffy Sling—but at the same reasonable price.

As always, Tuffy Slings are extra flexible and kink-resistant. It's almost impossible to kink a Tuffy. But if it does kink, you can always straighten it without materially damaging the fabric. Everyone who has used the new all-metal pressed on ferrule agrees that it adds a great deal to the service life of Tuffy machine braided wire fabric slings.

Your Tuffy Distributor Can Save You Money

Tell him what your future requirements in Tuffy Slings and Tuffy Hoist Lines are likely to be. He'll tailor his stock for you to draw against. You'll save the time, space, and cost of maintaining your own inventory.

FACTS ON FERRULE, SLINGS, FITTINGS, IN FREE NEW TUFFY SLING HANDBOOK

This new 60-page Sling Handbook gives you complete information (charts and rated working loads) on a larger line of factory-fitted slings. It tells you how to use versatile Tuffy Slings on dozens of different jobs. It shows you how the new Tuffy metal ferrule is pressed on the eye splice to make Tuffy machine braided wire slings safer and faster to work, and it shows you the most advanced sling fittings available. On top of all this, it contains a brand new engineer's handbook and a valuable rigger's manual.

If you buy, use or specify slings—if you are concerned with shop safety, efficiency, and long service life—you need this fully illustrated, comprehensive Tuffy Sling Handbook. Mail the coupon to us now for your copy of the new edition. No obligation.

union Wire Rope corporation

Specialists in high carbon wire, wire rope, braided wire fabric, stress relieved wire and strand.

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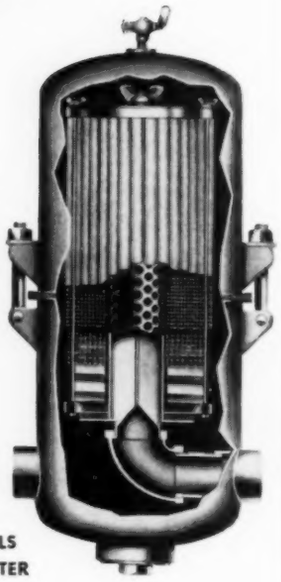
Do You Have Trouble Filtering These Liquids?

YOU NEED

STAYNEW LIQUID FILTERS

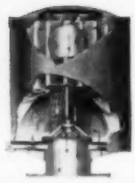


MODEL ELS
LIQUID FILTER

Name a liquid . . . any liquid! Somewhere in the world it is undoubtedly filtered efficiently and economically by a Staynew Liquid Filter. The world-wide use of Staynew Filters on thousands of liquids is proof of their adaptability to virtually any requirement. All known types of filtering media are available for any problem regardless of temperature, pressure, or corrosion factors. And, all Staynew Model ELS Liquid Filter bodies are available in steel, stainless steel, monel, herculoy and other non-corrosive materials. Construction can be according to ASME or API Code specifications. Let us know your requirements.

SOME OF THE LIQUIDS EFFICIENTLY FILTERED BY STAYNEW LIQUID FILTERS

Acetone
Acids
Adhesives
Alcohols
Alkalis
Ammonia
Asphalt
Benzene
Benzine
Beverages
Butane
Casein
Castor Oil
Caustic
Cellulose Solutions
Chlorine
Chocolate
Cleaning Fluids
Coating
Coolants
Cutting Oils
Emulsions
Enamels
Ethanolamine
Ethylamine
Extracts
Flameproofing Solutions
Fuel Oil
Furniture Polish
Gasoline
Glue
Greases
Gums
Hydraulic Fluids
Ink
Kerosene
Lacquers
Latex
Liquid Paraffin
Lubricants
Molasses
Naphtha
Paint
Pharmaceuticals
Propylene
Quenching Oils
Resins
Rubber Cements
Sizing
Soap
Solvents
Steam Condensate
Syrups
Tar
Turpentine
Varnish
Vegetable Oils
Viscose
Water
Wax



INTAKE FILTERS

LIQUID FILTERS

PIPE LINE FILTERS

ELECTRO-STAYNEW PRECIPITATOR

AUTOMATIC AIR FILTERS

PANEL FILTERS

SPECIAL FILTERS

DOLLINGER
PROTECTOMOTOR
STAYNEW FILTERS

DOLLINGER CORPORATION

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Send for 12-page Bulletin 300. Contains engineering and performance data, photos, descriptions of filtering media, recommended use of each, and other helpful data.

Dollinger Corporation, 95 Centre Park, Rochester 3, N. Y.

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS
ELECTROSTATIC FILTERS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS
VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS
AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

W. H. Mouquin

C. C. Bray

New Appointments Made In De Laval Chicago District

W. H. Mouquin has been named district manager of the Chicago office of De Laval Steam Turbine Company, Trenton, N. J., and C. C. Bray has been appointed regional sales supervisor at the same office.

These appointments are in the new Chicago sales and service headquarters in Forest Park, Ill.

American Machine and Metals Names Harvey to Sales Post

Leonard Harvey

Leonard Harvey has been appointed New England sales representative for the Niagara Filters and Tolhurst Centrifugals divisions of American Machine and Metals, Inc.

Harvey, formerly control laboratory supervisor with Fisher Scientific, has experience in the fine chemical, food processing, and pharmaceutical fields.

J. French Robinson Joins Republic Steel as Advisor

J. French Robinson, recently retired president of Consolidated Natural Gas Company, New York, and chairman of East Ohio Gas Company, Cleveland, has joined Republic Steel Corporation in an advisory capacity.

Robinson entered the public utility field in 1921 as geologist and engineer with the People's Natural Gas Company and Hope Natural Gas Company. He became director and president of that East Ohio Gas Company in 1940 and in 1951 went to New York as president of the Consolidated Natural Gas Company. He was general chairman of the Natural Gas and Natural Gasoline committee of the petroleum industry's War Council and is a member of numerous scientific and technical organizations.

Erratum

Name of The Texas Company inadvertently was omitted from the article "Simple Automatic Controls Pay Off" on page 16 of the February, 1956 issue of PIPE LINE INDUSTRY. The Badger Pipe Line System is jointly owned by Cities Service Oil Company (Delaware), The Pure Oil Company, Sinclair Pipe Line Company, and The Texas Company.

In Pipeline Service...

MAKE SURE YOUR SMALL PIPING IS JOINED SAFELY, TOO

■ W-S Forged Steel Fittings provide safe, tight connections for your small diameter, high pressure piping. In gathering lines . . . pump and compressor piping . . . instrument lines and other high pressure lines, 4" and under in diameter, W-S fittings protect you against costly down-time. They're drop-forged for extra strength and toughness—and they're safety-factor designed.

Watson-Stillman Fittings are available in screw-end and socket-welding types in carbon steel, stainless steels and alloy steels. Send for your copies of our informative catalogs.

W-S FITTINGS DIVISION

H. K. PORTER COMPANY, INC.
Roselle, New Jersey

For more data on advertised products, use Readers' Service Cards, last page.

Johnson to Assist Chairman Of Board at U. S. Steel

Howard Cooper Johnson has been appointed assistant to the chairman of the board of United States Steel Corporation.

Johnson started his business career with an investment banking firm in 1934. He joined the staff of the U. S. Naval Material Inspection Administration in 1941 and was appointed assistant to the secretary, Joint Chiefs of Staff in 1943. A year later he was assigned to the Office of the Secretary of the Navy. In 1945 he was a member of the San Francisco conference on drafting of the United Nations Organization.

Johnson served with the Office of United Nations Affairs, Department of State, for several years and was associated with the Ford Foundation for three years prior to joining U. S. Steel.

E. B. Miller to Represent Hammel-Dahl in St. Louis

The Hammel-Dahl Company has announced the appointment of The E. B. Miller Comany, St. Louis, as their new sales representative in that territory.

Everett B. Miller, in charge of the new organization, has had experience in the automatic control equipment field in Chicago, Milwaukee and St. Louis, having been associated with the Foxboro Company since 1935. He has been actively engaged in sales and service in those cities for the past 20 years.

Ollie Blodgett

Lee Sherwood

Gaso Pump and Burner Appoints North Central Texas Distributor

Gaso Pump & Burner Mfg. Co., Tulsa, has appointed Pump Engineering Company, Wichita Falls, Texas, as exclusive distributor for its products in the North Central Texas area.

Manager of the new distributing Company is Ollie Blodgett, and assistant manager Lee Sherwood, both qualified to apply sound technical knowledge to pumping problems by training that includes 15 years' experience in the purchase, engineering and application of water flood, salt water disposal and pipe line pumping equipment.

Pump Engineering Company will maintain a complete stock of Gaso parts, and provide service and maintenance on all Gaso equipment.

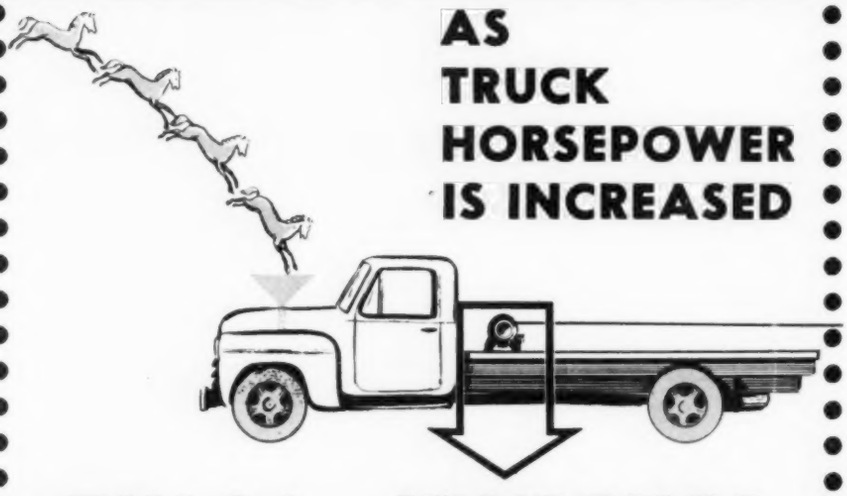
Bucyrus-Erie Names Stone Well Drill Sales Manager

Selden A. Stone has been appointed well drill sales manager for Bucyrus-Erie Company. He has been assistant drill sales manager with the firm since 1953.

S. A. Stone

Stone started in the oil field supply business with the Parkersburg Rig and Reel Company and later worked with Continental Supply Company. He served Franklin Supply Company for two years as store manager and field salesman, and International Derrick and Equipment Company.

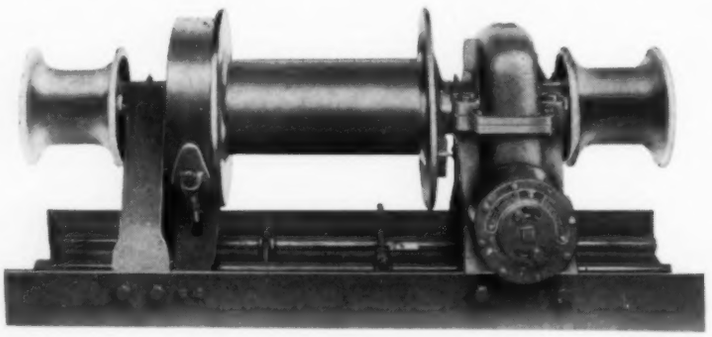
L. B. Birckhead, former drill sales manager, will serve in an advisory capacity in connection with spudder sales.



AS TRUCK HORSEPOWER IS INCREASED

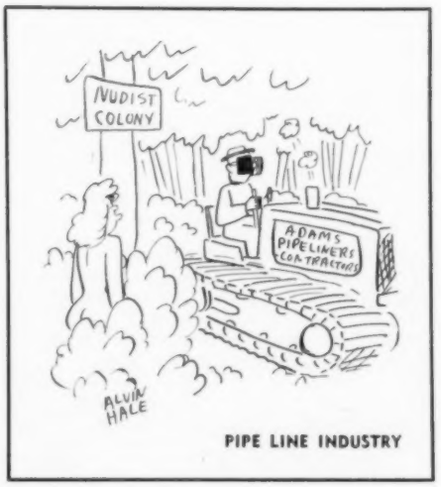
TULSA® WINCHES

ARE STRENGTHENED AND IMPROVED TO TAKE ADVANTAGE OF THIS AVAILABLE POWER



Over 28 models to choose from with capacities from 6,000 to 100,000 pounds . . . breaking point is OVER TWICE the rated capacity. See your nearest TULSA WINCH distributor for complete details.

Tulsa Winch
TULSA, OKLAHOMA DIVISION OF VICKERS Inc.



PIPE LINE INDUSTRY

Reputation Built on Performance
Experienced crews, adequate equipment, and modern know-how — a combination you can't beat for speed, quality, and complete satisfaction. Our reputation for top-notch, on-the-job performance, at bid price, eliminates undue construction costs and unnecessary delays. Our contract obligations are fulfilled, and pipeline operation begins, ahead of schedule.
H.B. ZACHRY CO.
PIPE LINE DEPARTMENT
TRANSIT TOWER, SAN ANTONIO, TEXAS

IT'S EASY

TO SELECT A PRESSURE OR TEMPERATURE CONTROL FOR ANY APPLICATION WHEN IT'S A

MERCOID®

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CONTENTS:

CONTROLS FOR PRESSURE—
DIFFERENTIAL PRESSURE—
TWO-STAGE PRESSURE—
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TWO-STAGE TEMPERATURE
LIQUID LEVEL
FLOAT OPERATION
LEVER ARM OPERATION

CASE STYLES TO MEET VARIOUS REQUIREMENTS
INDOOR (General Purpose)
OUTDOOR (Weather Resistant)
HAZARDOUS LOCATIONS (Explosion-proof)

ALL MERCOID CONTROLS INCORPORATE SEALED MERCURY CONTACTS

Write for Catalog No. 856-G
THE MERCOID CORPORATION
4201 Belmont Ave., Chicago 41, Ill.

Grobholz and Welsh Receive Worthington Promotions

R. K. Grobholz has been appointed manager of the Worthington Corporation Power Pump Sales division with headquarters at the corporation's Oil City, Penn., Works. Grobholz succeeds A. F. Welsh who has been appointed manager of the Marketing Research division.

R. K. Grobholz

Grobholz joined Worthington in 1943 as a test engineer in the Harrison Works Research and Development Lab, and served successively as application engineer for steam pumps and then power pumps for a period of eight years. In 1952, he was appointed power pump section leader and in April, 1954, he moved his headquarters to the corporation's Oil City Works as manager of the reciprocating pump sales section, the position he held until his present appointment.

Morrow Retires As President Of Joy Manufacturing

J. D. A. Morrow has retired as president of Joy Manufacturing Company and has been elected chairman of the board. John Lawrence was made president and chief executive officer, W. L. Wearly becomes executive vice president, and H. C. Nyquist is vice president, general sales.

Morrow has been president since 1940. Lawrence joined Joy in 1951 from SKF Industries, Inc. where he was manufacturing and engineering vice president. He began with Joy as vice president, manufacturing; then was in charge of both manufacturing and engineering, and for a year and a half has been executive vice president.

Wearly has been with Joy since 1937 and has served as vice president, general sales for the last three years. Nyquist came to Joy in 1946 from Tennessee Coal, Iron and Railroad Company, where he was chief engineer of the Coal Mining division.

Order Your Copy of 1955 Pipe Line Industry Index

The complete editorial index covering all issues of PIPE LINE INDUSTRY published during 1955 has been prepared and is bound separately in convenient pamphlet form. It will be sent free to all subscribers who write requesting copies.

Use the Readers' Service postcard, last page this issue, to order your index. Or address orders to Librarian, Gulf Publishing Company, Box 2608, Houston 1, Texas. The supply is limited.

We challenge you

to find better

PROTECTIVE CLOTHING!

illustrated above: ¾ length coat

Sawyer

for every industry where personnel protection and safety are vital, only Sawyer Neoprene Latex Clothing offers *all* these advantages:

- **100% protection against oils, chemicals, alkalies, abrasion — and other hazards!**
- **"Exclusive Coating Process" . . . (for years and years of extra wear and durability) — *original* with Sawyer!**
- **guaranteed not to peel, blister or crack in ordinary usage!**
- **double interlocked sewn seams that *can't* come apart!**
- **solid brass or non-conductive fastenings that *can't* rip off or corrode!**
- **designed for roomy, action-free comfort!**

Sawyer clothing also Rubberized or Oiled. Full range of jackets, pants, coats, hats, aprons for *more* efficiency, *more* economy, *more* protection on *every* job!

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specialists in Protective Clothing for more than a century
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LUBRICATE PLUG VALVES

in seconds — instead of minutes

with this timesaving combination

Yes, seconds are all it takes to lubricate plug valves, today. You'll eliminate waste, and save time and effort with this combination: Walworth High Pressure Lubricant Gun, Walworth Button-Head Fittings, and Walworth Jumbo Size Lubricant Sticks. They'll pay for themselves quickly and are adaptable to most of the lubricated plug valves that are in use today.

Walworth High Pressure Lubricant Gun. This is the only gun available today that satisfactorily handles the stick form, full-bodied lubricants needed for proper lubrication and sealing of plug valves. Easy to operate; two Jumbo Size Lubricant Sticks fill the barrel.

Walworth Button-Head Lubricant Fittings. Use them as lubricant fittings or as regular lubricant screws with standard size lubricant sticks. Just slip hose coupling onto fitting for a leakproof connection.

Walworth Jumbo Size Lubricant Sticks. Individually wrapped and packed ten to the box; clean and easy to handle . . . eliminate messy loading. Types available for most line fluids. Always use Walworth Lubricants in Walworth Lubricated Plug Valves.

Start saving today . . . call your nearby Walworth Distributor. He'll be glad to supply Walworth High Pressure Lubricant Guns, Button-Head Fittings, and the right Jumbo Size Lubricant Sticks for any lubricated plug valve service condition.

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Manufacturers since 1842

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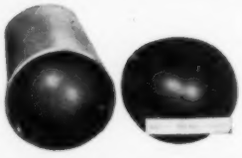

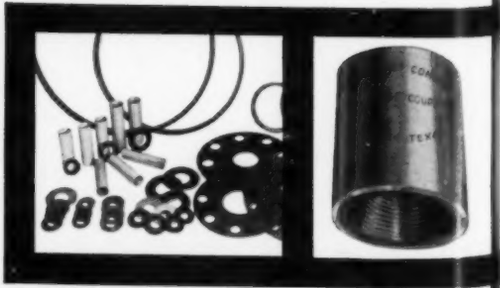

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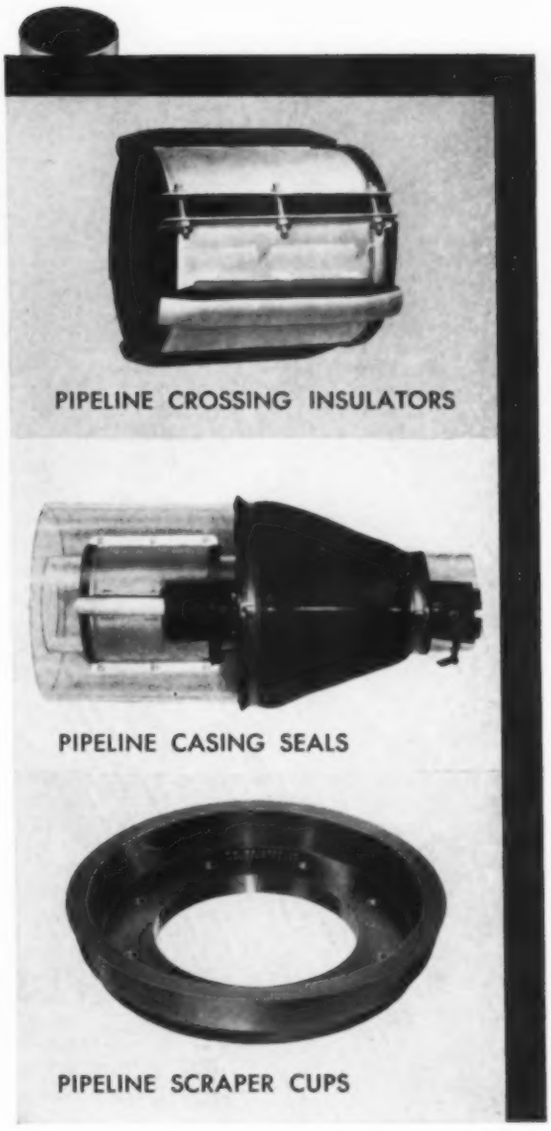

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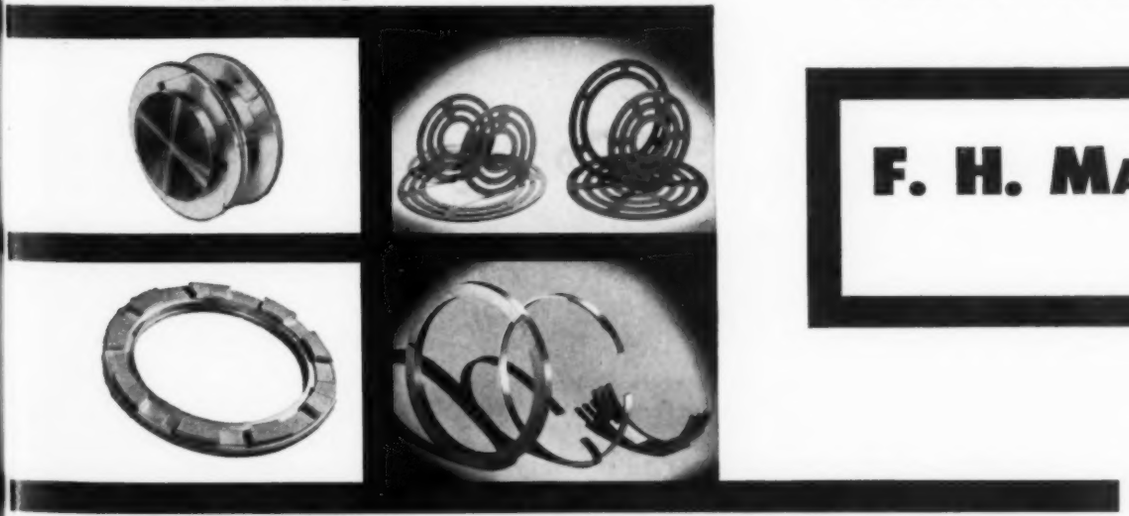

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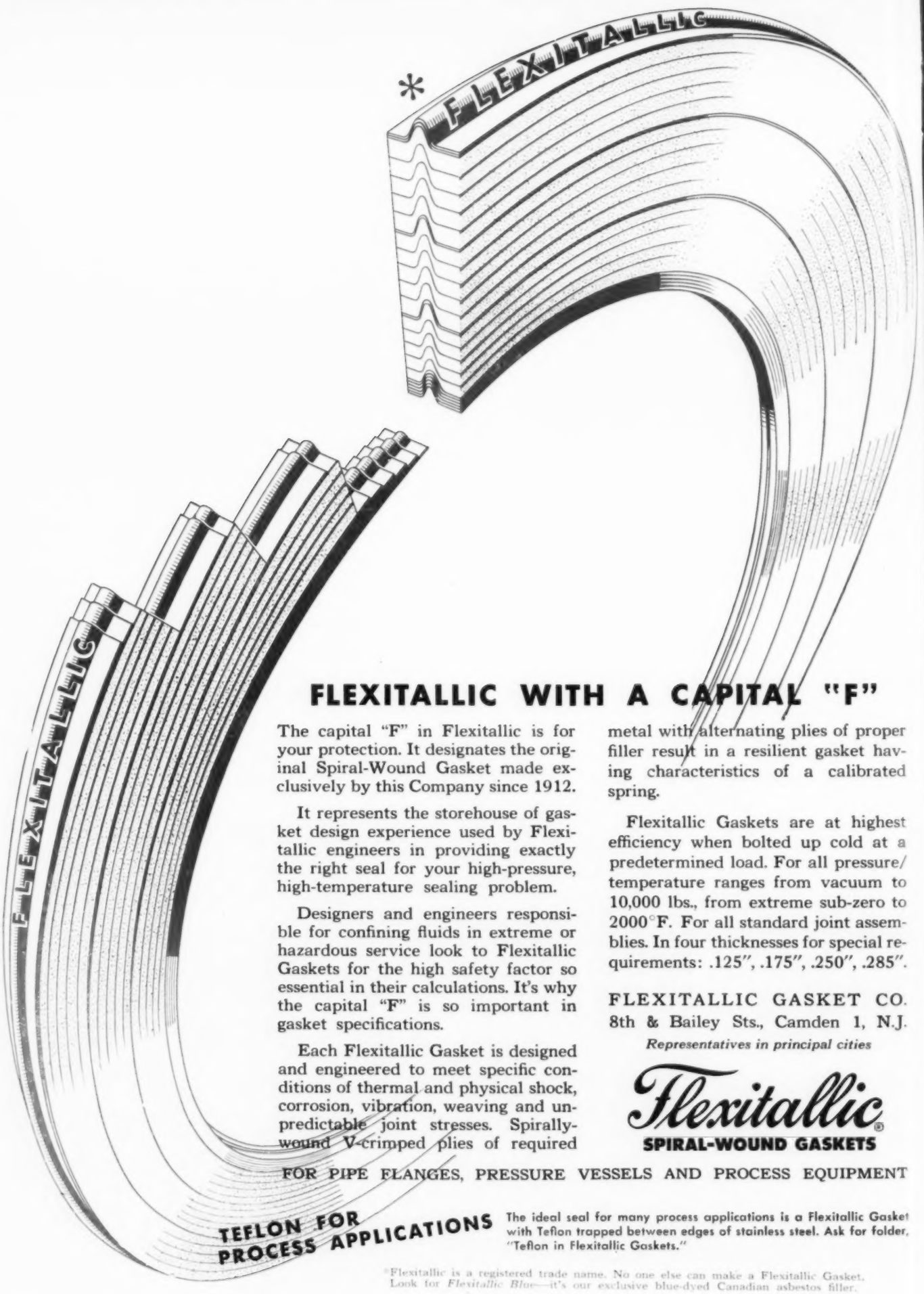

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The capital "F" in Flexitallic is for your protection. It designates the original Spiral-Wound Gasket made exclusively by this Company since 1912.

It represents the storehouse of gasket design experience used by Flexitallic engineers in providing exactly the right seal for your high-pressure, high-temperature sealing problem.

Designers and engineers responsible for confining fluids in extreme or hazardous service look to Flexitallic Gaskets for the high safety factor so essential in their calculations. It's why the capital "F" is so important in gasket specifications.

Each Flexitallic Gasket is designed and engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally-wound V-crimped plies of required metal with alternating plies of proper filler result in a resilient gasket having characteristics of a calibrated spring.

Flexitallic Gaskets are at highest efficiency when bolted up cold at a predetermined load. For all pressure/temperature ranges from vacuum to 10,000 lbs., from extreme sub-zero to 2000°F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285".

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SPIRAL-WOUND GASKETS
FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

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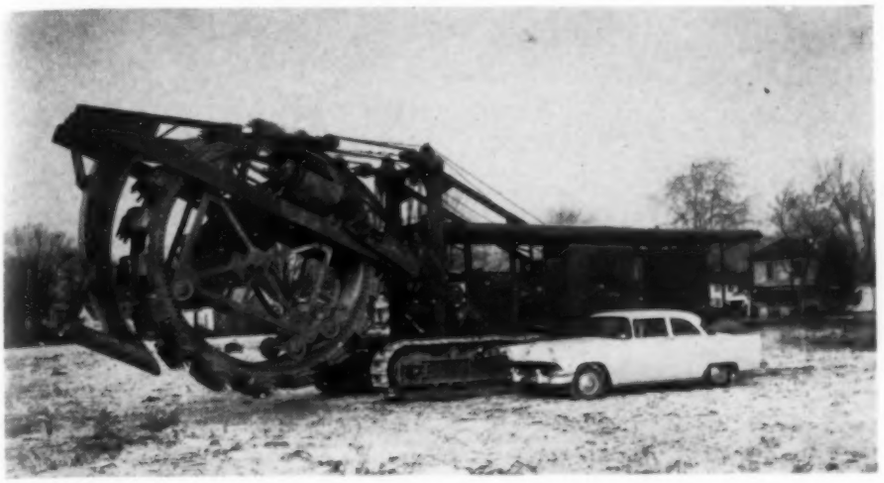
The ideal seal for many process applications is a Flexitallic Gasket with Teflon trapped between edges of stainless steel. Ask for folder, "Teflon in Flexitallic Gaskets."

*Flexitallic is a registered trade name. No one else can make a Flexitallic Gasket. Look for *Flexitallic Blue*—it's our exclusive blue-dyed Canadian asbestos filler.

What's New in Equipment

for the Pipe Line Industry



Ditching Machine

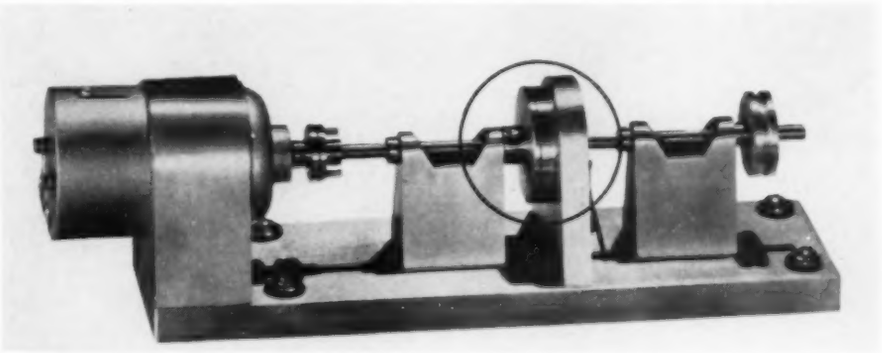
The Gar Wood-Buckeye 330, world's largest ditching machine, has completed its first field trials. Designed and built in Gar Wood Industries' Findlay division, the giant machine excavates 600 cubic yards of dirt per hour, cuts a trench 11-foot 3-inches deep, 5-feet 4-inches wide. The new ditcher, which stands 16 feet high, was designed to meet the needs of excavating trench for larger diameter pipe line construction.

The digging capacity of the new ditcher has been rated at 600 cubic yards per hour. Matched against a ¾-yard backhoe, the 330 ditcher is eight times more efficient.

A hydraulic power steering arrangement provides the operator with fingertip steering control for the 110,000-pound ditcher. The 330 operates on a combination of 30-inch tracks in the rear and 30-inch pneumatic tires in front. Power from a Caterpillar diesel rated at 220 operating horsepower flows through a torque converter to an arrangement of two Allison torquematic transmissions. The transmissions provide the speed ratios for the traction drive and a choice of 15 speeds for the digging wheel drive.

The digging wheel is lowered or raised by two individual hydraulic hoist units. Each has separate controls to allow independent or simultaneous operation. Either the front or rear of the digging wheel can be raised or lowered.

For more data circle **No. E1** on Readers' Service Card, last page this issue.



Permanent Magnetic Clutch

A new type permanent magnetic clutch, manufactured by Locke Machine Company, soon will make its appearance on the American market. Developed in Germany, this clutch requires no electric current for its operation except for an impulse for engaging or disengaging.

Lack of a continuous electric current supply has proved of interest to manufacturers of battery operated devices. This clutch will be available in the fractional horsepower range and it is intended that they be made for larger applications also. Remote control operation is possible.

For more data circle **No. E2** on Readers' Service Card, last page this issue.

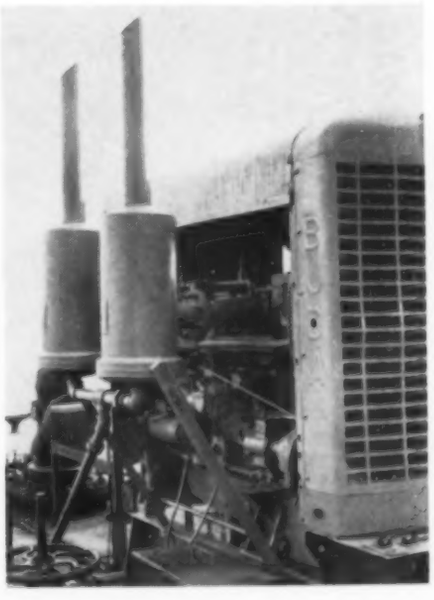
Purge Type Thermocouple

Trinity Equipment Corporation has introduced a purge type thermocouple assembly. Especially developed for temperature conditions up to 2900° F. at high pressures in reactors, catalyst beds, glass plants, this unit consists of a silica-free ceramic tube which houses the platinum purge tube and platinum-platinum rhodium couple.

The gas purge, at slightly higher than vessel pressure, flows through the purge tube and over couple junction, then out through the vent hole in the flange. The purge pressurizes the ceramic tube and prevents corrosion of the couple. Note that the vents in the flange are constructed to protect the ceramic tube against pressure surges in the vessel. The ball-type socket on this tube also permits easy alignment with vessel wall and enables well to shift with expansion of vessel lining.

Trinity purge type assemblies are equipped with a connecting union, which minimizes damage to assembly during installation and thermocouple is sealed with lava-packed gland to protect against ceramic tube failure.

For more data circle **No. E3** on Readers' Service Card, last page this issue.



Water Separator Snubber

The Burgess-Manning Company has developed a water separator snubber which controls exhaust temperature in an engine exhaust system to safe limits (below flash point). The WSS-4 snubber also provides exhaust silencing and spark arresting in the same unit.

In the illustration two WSS-4's are shown installed aboard a barge on the split exhaust manifold of the barges' Buda en-

Save time! Keep informed! Circle numbers on Readers' Service Cards, last page this issue

gine, which drives the cargo pump. A water pump driven by the engine fan belt pumps water from a storage tank on deck to the exhaust pipe directly ahead of each WSS-4. Water introduced into the exhaust pipe reduces the temperature; then is removed from the exhaust by centrifugal action and returned to the water reservoir on deck to be recirculated through the system. The action of the WSS-4 snubber causes the water to leave at the bottom and the safely cooled exhaust gases discharge from the top.

Tests run on this installation showed the water temperature in the reservoir to be between 160° F. and 180° F., and the temperature of the exhaust in the tail pipe to be between 200° F. and 244° F.

For more data circle **No. E4** on Readers' Service Card, last page this issue.

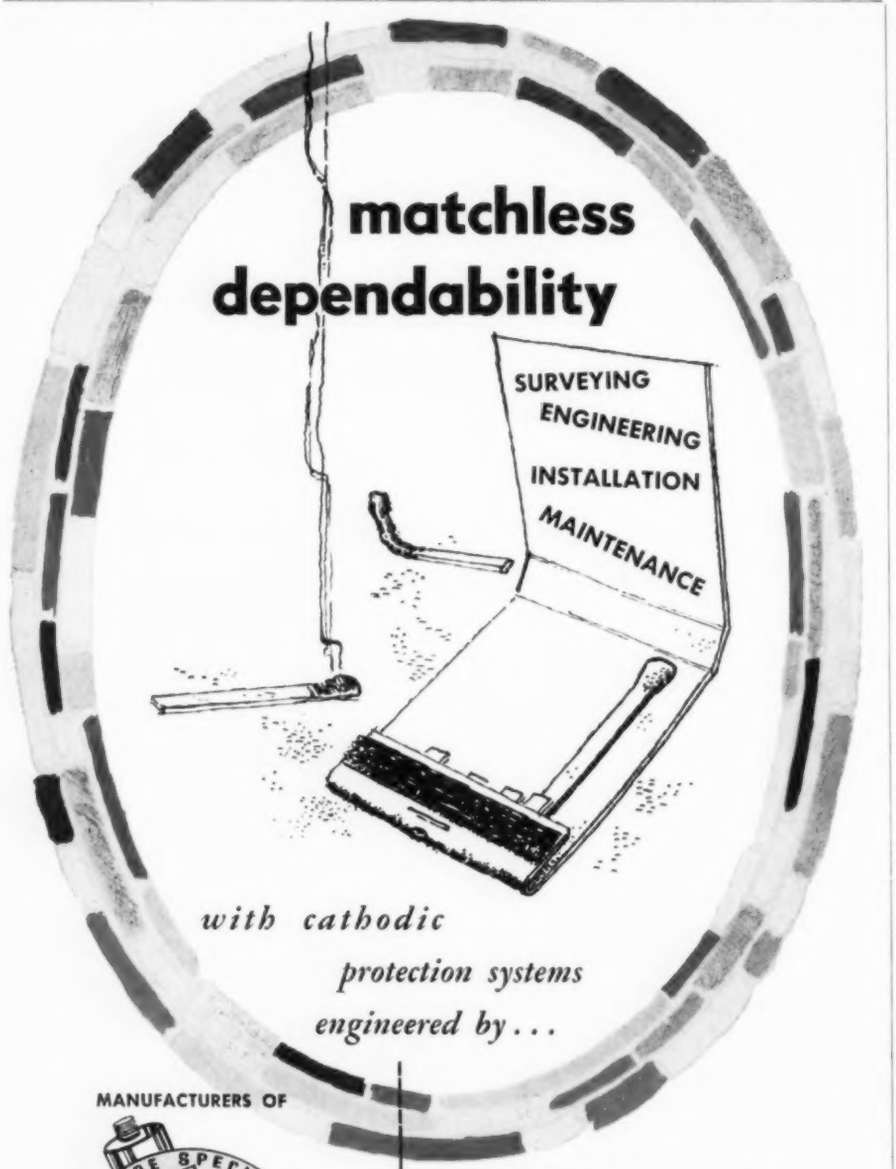
Welding Unit

Hobart Brothers Co. has announced a new design in their "Weldmobile," a self-contained self-propelled welding unit with engine directly coupled to the generator. Larger rear wheels with ground gripper tires, implement tires in the front and greatly increased ground clearance at both axles have improved mobility over that of previous models.

The unit is designed to provide a mobile self-propelled welding unit for installations in which welding applications occur at widely separate points. By traveling directly to the job and being ready to weld without waiting for power-line hookup, the unit saves hours of time. Its towing capacity, also a time-saver, is rated at 2000 pounds draw-bar pull.

The 400-amp model is powered by a Chrysler 6-cylinder industrial engine; the 600-amp model, by a Chrysler V8-cylinder industrial engine. In addition to welding power, the Weldmobile can supply up to one kilowatt (110 volts DC) auxiliary power for operation of lights and electric motor powered equipment.

For more data circle **No. E5** on Readers' Service Card, last page this issue.



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Voltmeter

Associated Research, Inc. has announced the availability of an accurate, portable field instrument designed to measure structure to soil and structure to structure potential. It uses no tubes or batteries and eliminates the need for bulky, delicate voltmeters of the potentiometer or vacuum tube types. It measures true pipe-to-soil voltage by an entirely different principle to an accuracy of two per cent or better. Its total weight is six pounds.

For more data circle **No. E6** on Readers' Service Card, last page this issue.

Chain Repair Anvil

Pioneer Specialties, Inc. has announced a new chain repair anvil to be used with standard inexpensive cold shuts.

The three-lobed anvil is designed so that each lobe accommodates a different chain size covering the range most suited for the service. Thus, for drilling rigs the lobes are for ¼-inch, 5/16-inch, and ⅜-inch

THAT'S LOUISIANA MUD and it's heavy, wet and sticky, but these big spoil banks disappeared fast once the Cleveland 190 Backfiller bit into them on this 30" gas line spread. One of several owned by the O. R. Burden Construction Corporation, this fast-working, big-capacity backfiller is one-man operated. It backfills and travels simultaneously—in either direction—and does a thorough clean-up job. Saves dozer time on creek and road crossings, too! Put the 190 on *your* next job—it's efficient and economical not only on the big jobs but on smaller diameter lines as well. *Talk it over with your Cleveland distributor.*

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40,000 MILES
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PIPE CUTTER

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NEW... DELTA COLOR CODE

SAVES YOU: VALVES TIME LUBRICANT ERRORS

The Delta Color Code has been tried and proved foolproof . . . virtually impossible to lubricate your plug valves with incorrect lubricant. Identify each plug valve service by attaching colored tab to Delta Lubricating Fitting, fit colored grip on handle of DELTA Gun, then fill gun with the proper colored Desco Lubricant. Each lubricant is colored to match service.

There is no charge for the DELTA COLOR CODE when you use Desco Lubricants. Write for further information.

AMBER	GREEN	RED	BLACK
General Hydrocarbon Services	L.P.G. Services	Acid Services	Hi Temperature Services

The Only Complete Plug Valve Lubrication Company

DELTA ENGINEERING SALES CO.

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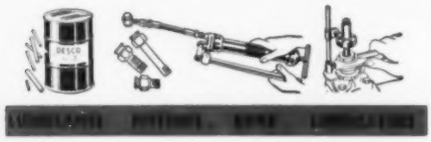
DELTA-DESCO

PLUG VALVE LUBRICANTS AND EQUIPMENT

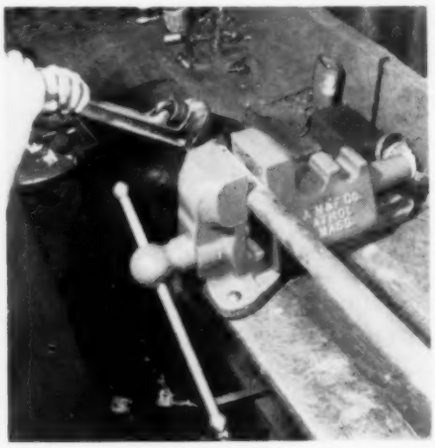


chain; for trucks, the lobes fit ⅜-inch, 7/16-inch, and ½-inch chain, respectively.

The first product of this type on the market, the anvil can be used to repair a chain quickly. To repair a chain or attach a grab-hook, the cold shut is inserted in the proper size groove in the top of the anvil and the tine is driven down through the eye. The next step is to insert the cold shut in the end of the same leg. This holds the tine vertical for peening to prevent it pulling back through the eye. Or, the anvil is equally useful when welding the tine to the eye.

(This item supplements Pioneer Specialties, Inc. data on Pages 4174-4175 of the Composite Catalog, 21st Edition.)

For more data circle **No. E7** on Readers' Service Card, last page this issue.



Heavy Duty Vise

The Athol Machine & Foundry Company is introducing to the construction and allied fields a heavy duty vise weighing 150 pounds of semi-steel construction. This vise has a gripping surface of five inches by four inches on the face of each jaw with a total depth of six inches. Machined into the heat-treated tool steel jaw facing is a full five-inch pipe grip, which will take a pipe or rod from one-eighth-inch to six inches in diameter and give a full five-inch long grip on both sides of the pipe or rod to give maximum holding power for freeing fittings or nuts.

The top of the jaws are massive and have an area large enough to be used in many cases for riveting or as an anvil surface when necessary. Because of the ruggedness of this vise, it is an excellent vise for bending heavy iron bars.

For more data circle **No. E8** on Readers' Service Card, last page this issue.

Identichart

A device that permits the remote selection of numbers or letters to be printed on strip charts has been developed by Royson Engineering Company. The print wheel on the unit can have 8, 10, 12, 18 or 24 positions, with the position being selected from a remote point, then caused to print for the purpose of identifying events on the recorder chart.

Called the RI-3 Identichart, the unit is useful for identifying range, chart speed, channel number or other variation that

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Lowell #50-A Reversible Ratchet Wrench

for speedy installation of pipe line mechanical joints.

Reversible ratchet allows fastest possible tightening of 5/8" hex bolts —special 8" handle assures correct torque, as suggested in American Standard Specifications.

Ask your local industrial distributor for the #50-A Wrench by *Lowell* – makers of industrial wrenches for more than 85 years

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LASTS THE LIFE OF THE LINE . . .
LESS EXPENSIVE THAN A FIELD-WELDED VENT

HEAVY ALUMINUM
Entire marker-vent is cast of heavy aluminum alloy. Resists damage from rifle bullets.

LARGE PANEL
7" by 12" panel offers sufficient space for company trade mark and message in raised letters.

CHOICE OF COLORS
Signs available in any color combination to match company colors.

SCREENED VENTS
Heavy rust-proof screening keeps out insects, allows proper venting.

HEAVY COLLAR
Fits 2", 3" or 4" pipe. Weldable collar available at slightly higher cost.

EASY INSTALLATION
Simply slip the vent collar down over pipe and tighten two set screws.

Topaz sales engineers will make field surveys and free estimates of your particular needs.

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Dealerships available in many domestic and foreign territories.
Write or wire Tod Pazdral Pipeline Specialties for details.

*Patent Pending

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SAFETY-ENGINEERED PIPE LINE SLING

GREENHEAD SLINGS have approximately 100,000 lbs. more strength than ordinary slings. GREENHEAD SLINGS give you lower cost, greater durability, lighter to handle, easily operated by one man.

- 10 ply belting covers ropes on pull-out side
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- Cable Protector saves wire ropes
- Tough, cast, bearing-plates
- 4-9/16" wire ropes in basket hitch, 222,400 lbs. ultimate strength
- Completely eliminates the old ball and pins

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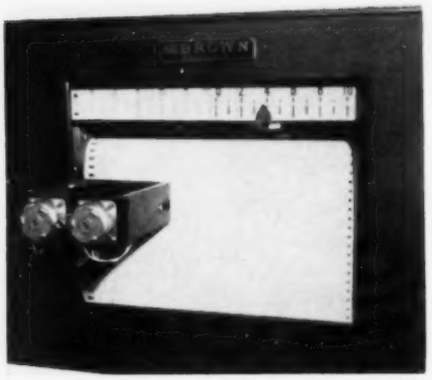

needs to be identified when the chart is reviewed. The device can have two print wheels if desired, each independently set by separate, remote switches. The printing pulse causes the device to print whatever characters have been selected.

The Identichart kit consists of a strip of rubber for the chart platen, mounting screws, plexiglass window to replace the original one in the recorder door, plastic transparent cover for the device itself and installation instructions. The unit can operate on any AC or DC voltage from 24 to 110 volts.

For more data circle **No. E9** on Readers' Service Card, last page this issue.

Tank Switching System

Black, Sivalls & Bryson, Inc. has introduced auto-switch for tank batteries, a pneumatic tank switching system powered by lease gas. Auto-switch handles many daily lease routines now performed by pumpers. Each tank is equipped with a relay which responds to an internal tank float to open and close the fill valve. Easily adapted to existing batteries, auto-switch has an interlock to safeguard drain and fill valve sequencing. Interlock unit mounts to the various types of standard drain valves. In addition, auto-switch provides for individual tank isolation and will service any number of tanks.

(This item supplements Black, Sivalls & Bryson, Inc. data on pages 649-660 of the Composite Catalog, 21st Edition.)

For more data circle **No. E10** on Readers' Service Card, last page this issue.

See Composite and Refinery Catalogs, or Write for Specifications Folder

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PIPE SADDLES AND REDUCERS

Nozzle sizes from ¼" to 24"

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Also for pressure vessel heads

Nominal pipe sizes 1" to 30"

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Pure Colloidal Concentrate

Ounces Only Once a Week Remove and Prevent Boiler Scale and Corrosion.

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RUSTEND—for all metal surfaces

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Economy because of quality can be yours with POLYKEN Protective Tape Coatings

HOW IS THIS POSSIBLE? When you specify high-quality *Polyken*, you *automatically* specify *low-cost application* as well as long-range protection.

More and more pipeline operators are realizing the unsurpassed qualities of modern polyethylene as a corrosion resister . . . and that the best need cost no more.

Factory controlled production from controlled materials—the source of quality—is likewise the source of low-cost field application.

By transferring your coating production *to our plant*, you get:

1. *Polyken* "Controlled Strength"—careful control in the selection and mass processing of raw materials to assure you "all work—no waste";
2. Uniform composition, thickness and adhesion;
3. Application right from the roll—little handling, no heat, no thinners, no solvents, no drying, no cooling, no clean-up time required;
4. High-speed, low-labor power taping for "big inch" as well as "little inch" installations;
5. Lowest equipment investment and manpower costs.

We can't figure your costs here in dollars and cents. But show us your plans—and we suspect you'll be surprised at how little this method costs you.

Let's talk it over now. Write, wire or phone today. The Kendall Company, Polyken Sales Division, Department PL-C, 222 West Adams Street, Chicago 6, Illinois (Randolph 6-4250).

Complete catalog, Sweet's Industrial Construction File, Sec. 9c/Ke

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PROTECTIVE COATINGS

THE KENDALL CO., POLYKEN SALES DIVISION

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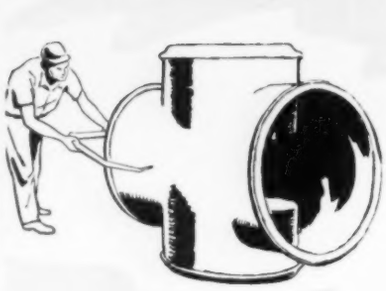


W-K-M Valves

JUST LIKE INSURANCE

W-K-M's precise control of each step of the manufacturing process insures the excellence of every W-K-M Valve. Depending upon the size and the type of the valve, there will be over 300 separate inspections made on every single valve produced in the W-K-M plant. This is your assurance that W-K-M Valves will not only meet your most rigid specifications, but will provide trouble-free service for years to come.

Receiving Inspection

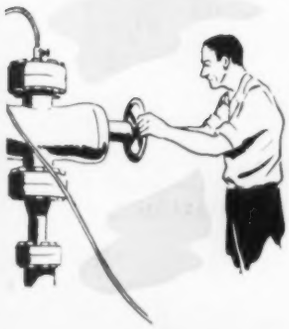
Raw Castings and materials received in warehouse are inspected for conformity to dimensional specifications.

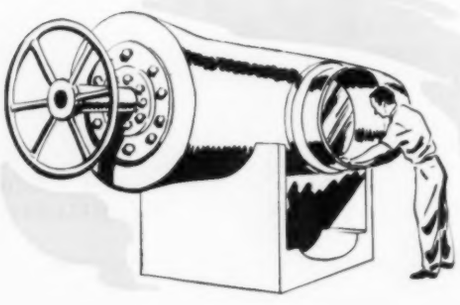
Chemical & Metallurgical Analysis

Chemical and physical tests are run to determine conformity to ASTM specifications. In the case of some high pressure valves, the castings are inspected by gamma ray technique. Many other castings and materials are checked by magnetic particle methods to assure soundness of structure.

Manufacturing Inspection

All manufactured parts inspected for dimensional accuracy and finish. Also metallurgical and physical testing procedures are applied to maintain rigid control of these parts.





Testing

All valves tested 100% on high pressure test rack to test soundness of body and sealing at both seats.

W-K-M Manufacturing Company, Inc.

A subsidiary of acf industries incorporated

P. O. Box 2117, Houston 1, Texas Los Angeles, California

Export Office: 45 Rockefeller Plaza, New York, N. Y.

New Equipment Literature

For more data on New Equipment or copies of Catalogs and Literature reviewed in this issue, use the Reader Service postcards just inside the back cover and facing the Advertisers Index. Simply circle code numbers of items desired—sign and mail card.

Protective Coating Catalogs

Two new illustrated catalogs describing the Amercoat method of corrosion control have been issued by Amercoat Corporation. One catalog is for the industrial construction field, the other is for plant maintenance engineers. Protective coatings systems are described which can incorporate corrosion resistance into a project by planning for their use prior to construction. The plant maintenance catalog describes corrosion control in the operating plant.

The various corrosion-resistant coatings systems manufactured by the company are outlined. Amercoat coatings provide resistance to corrosion for structural steel, tanks, piping, ductwork and other types of industrial structures and equipment. Amercoat also makes coatings to protect the interiors of tanks containing corrosive chemicals. The new catalogs contain lists of such chemicals.

To get a copy circle **No. E11** on Readers' Service Card, last page this issue.

Nuts and Bolts

Caterpillar Tractor Company has prepared a booklet entitled "Let's Talk Nuts and Bolts" which discusses the differences of nuts and bolts, depending upon the quality of material from which they are made, the type of heat treating they receive and inspection given them before use. The brochure is also available in French, Spanish and Portuguese.

To get a copy circle **No. E12** on Readers' Service Card, last page this issue.

Drawout Switchgear

Nelson low voltage, metal-enclosed drawout switchgear using air circuit breakers is the subject of a 16-page brochure just released by Nelson Electric Manufacturing Company.

The brochure contains photographs of the component parts of the low voltage switchgear and cross section drawings of both indoor and outdoor units. Another page is devoted to showing different standard arrangements of circuit breakers and instrumentation and a foundation plan for outdoor units.

Two circuit breaker selection tables contain valuable information for the engineer specifying a low voltage switchgear.

To get a copy circle **No. E13** on Readers' Service Card, last page this issue.

Diaphragm Valve

Straight-through flow with no dam to trap suspended matter is an advantage of the Wynn straight-through diaphragm valve manufactured by the Stockdale Engineering Company.

Particularly useful for providing two-way, leakproof control of acids, oils, alkalis, slurries and most hard-to-handle fluids, this self-draining valve provides an unrestricted path for fluid to pass across the smooth valve floor, keeping pressure up and eliminating the necessity of clean out ports.

A bulletin describing other advantages and operational procedure of the valve, including engineering drawings and dimension tables, is available.

To get a copy circle **No. E14** on Readers' Service Card, last page this issue.

Automatic Controls

The Mercoid Corporation has issued a 52-page catalog on the Mercoid mercury switch equipped controls. A few of the many types of controls covered in the catalog are blower controls, hot water and steam boiler controls, damper controls, differential pressure controls, gas controls, overpressure controls, and many others. Complete drawings and specifications, ordering data and list prices are given for all the products.

To get a copy circle **No. E15** on Readers' Service Card, last page this issue.

Hoisting Equipment

Silent Hoist & Crane Co., Inc. has released two bulletins on Silent Hoist materials handling equipment for construction departments and Silent Hoist equipment for oil and refinery industries.

The bulletin on equipment for the oil industry includes information on the power swing boom cranes for motor trucks, capstans and winches for motor trucks, the Krane Kar mobile power swing-boom crane, the Steve-Krane mobile front boom crane, the Krane Krawler mobile power swing-boom crane, lift truck and ram truck.

To get a copy circle **No. E16** on Readers' Service Card, last page this issue.

Fittings and Valves

New bulletins on Van-Cor Pipe, fittings and valves made by The Colonial Plastics Manufacturing Company have been issued. The three bulletins are furnished as a unit. One describes chemically-resistant pipe with normal impact strength; another bulletin describes chemically-resistant pipe with high impact strength; and the third is devoted to valves.

To get a copy circle **No. E17** on Readers' Service Card, last page this issue.

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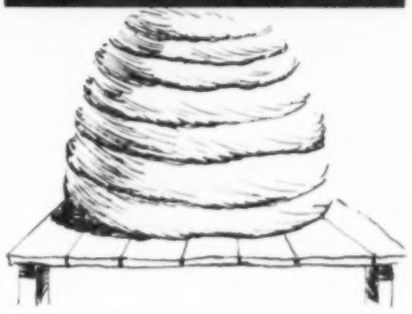

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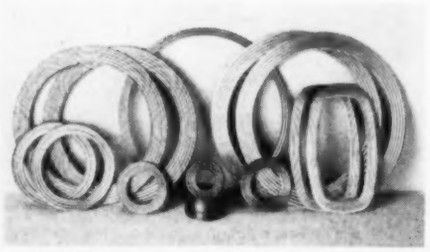

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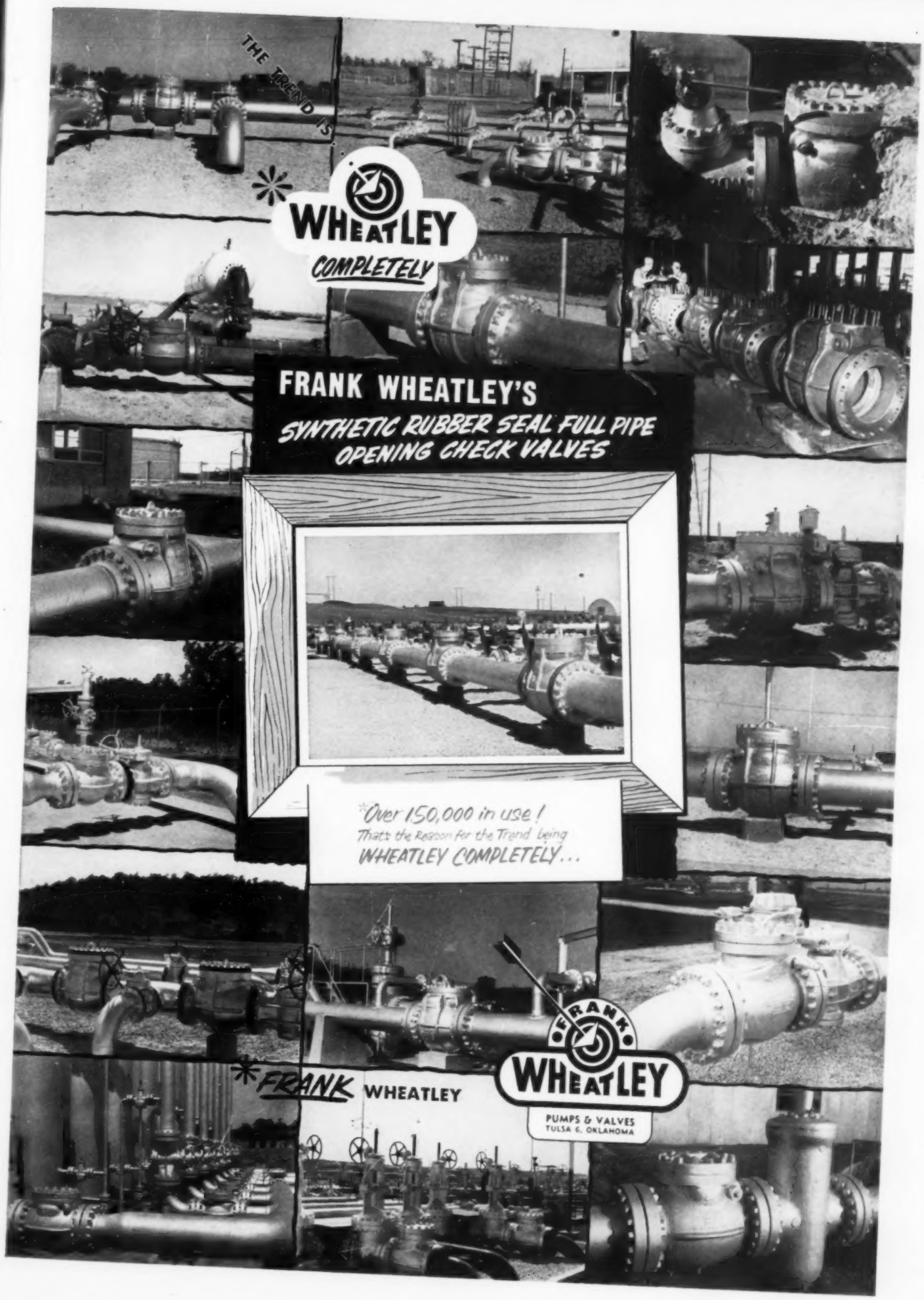
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